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02 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics. **2639**

03 AUXILIARY SYSTEMS

Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines; hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems. **2642**

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Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology. **2647**

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Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences. **2652**

06 CHEMISTRY

Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants. **2654**

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Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation. **2664**

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Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation. **2676**

10 ELECTRONICS
Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see: Specific Physics Categories. **2682**

11 FACILITIES, RESEARCH AND SUPPORT
Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations. **2686**

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Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion. **2689**

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Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences. **2694**

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Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras. **2707**

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Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics. **2729**

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Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants. **2802**

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Includes reports of a broad nature related to industrial applications and technology, and to basic research; defense aspects; law and related legal matters; and legislative hearings and documents. **2807**

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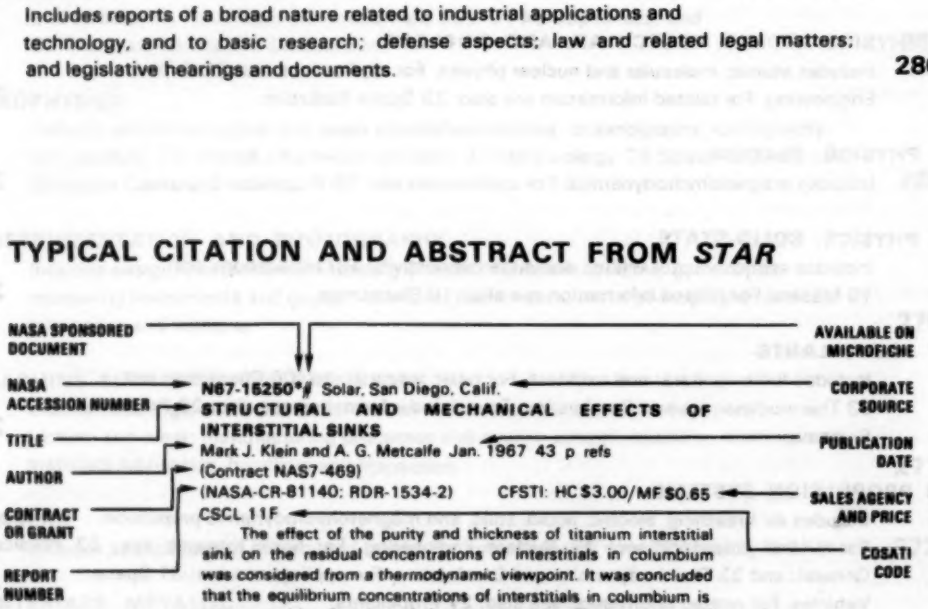
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TITLE
STRUCTURAL AND MECHANICAL EFFECTS OF INTERSTITIAL SINKS
PUBLICATION DATE
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Mark J. Klein and A. G. Metcalfe Jan. 1967 43 p refs
(Contract NAS7-469)
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(NASA-CR-81140; RDR-1534-2)
CFSTI: HC $3.00/MF $0.65
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The effect of the purity and thickness of titanium interstitial sink on the residual concentrations of interstitials in columbium was considered from a thermodynamic viewpoint. It was concluded that the equilibrium concentrations of interstitials in columbium is not a sensitive function of these parameters. The structure and hardness of Ti/D-43 diffusion couples were correlated with the partitions of interstitials between the two metals. A reduction in the oxygen and carbon concentration in the D-43 correlates with an increase in the grain size and a change in the grain morphology of this alloy. The equilibrium partition of interstitials between the titanium and the D-43 is believed to account for an increase in the hardness of the titanium, but this partition does not seem to affect the hardness of the D-43.
Author

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Scientific and Technical Aerospace Reports

A Semi-monthly Publication of the National Aeronautics and Space Administration

01 AERODYNAMICS

Includes aerodynamics of bodies, combinations, internal flow in ducts and turbo machinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 31 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

N67-27805# Minnesota Univ., Minneapolis.
MODEL LAWS GOVERNING PARACHUTE PERFORMANCE IN MARTIAN ENVIRONMENT
H. G. Heinrich [1966] 27 p refs Presented at the Ann. Joint Meeting DGRR/WGLR, Bad Godesberg, W. Germany, Oct. 1966 Sponsored in part by GE
CFSTI: HC $3.00/MF $0.65

The aerodynamic and dynamic performance characteristics of subsonic and supersonic parachutes are influenced by the air density, wind shear layers in the atmosphere, and the gravitational constant. It is shown that the rate of descent, dynamic stability characteristics, and the response to crosswinds are functions of the steady state aerodynamic coefficients in combination with inertial effects. The coefficients as well as the parachute opening characteristics depend on the mass flow through the canopy material. When considered as a porous screen, the canopy material has a distinct air resistance, which is a function of the Reynold-, Mach- and Knudsen numbers with the dimension of the screen openings being the characteristic length. In view of these relationships, model laws are suggested which allow the prediction of parachute performance on Mars based on experimental results obtained in the Earth's atmosphere. Author (ESRO)

N67-27945# Army Missile Command, Huntsville, Ala.
A CORRELATION OF THE BASE DRAG OF BODIES-OF-REVOLUTION WITH A JET EXHAUSTING THROUGH THE BASE
Charles E. Brazzel and James H. Henderson *In* Army Dept. Proc. of the 1966 Army Sci. Conf., Vol. I 26 Aug. 1966 p 63–77 refs (See N67-27941 15-34)
(AD-634662)

An empirical estimation technique, based on experimental data, is formulated for determining the correlation of base drag of bodies of revolution with a jet exhaust through the base. This formulation leads to a better understanding of the parameters required for optimum missile configuration determination. The empirical estimation can be used for a computerized missile trajectory analysis, as well as for estimating base drag by using only a slide rule or a desk calculator. Jet parameters discussed include nozzle diameter, nozzle exit angle, jet Mach number, and nozzle position; and external parameters are free-stream Mach number, body geometry, and body boundary layer. M.W.R.

N67-28071# Royal Aircraft Establishment, Farnborough (England).
THE PERFORMANCE OF FANS IN HOVERCRAFT. A METHOD OF REDUCING EXPERIMENTAL RESULTS
A. J. Burgess Nov. 1965 26 p refs
(RAE-TR-65240) CFSTI: HC $3.00/MF $0.65

A new method for reducing data on hovercraft fan performance is proposed which is expected to lead to a simplification of model and flight test procedures. The method is shown to be theoretically justified, and supporting experimental evidence is provided from models with both solid and flexible duct geometry. Author

N67-28140 Royal Aircraft Establishment, Farnborough (England).
A THEORY OF THE AERODYNAMIC INTERFERENCE BETWEEN A HELICOPTER ROTOR BLADE AND A FUSELAGE AND WING IN HOVERING AND FORWARD FLIGHT
A. R. S. Bramwell and J. B. B. Johnston Jun. 1965 86 p refs
(RAE-TR-65127)

A two-dimensional analysis is made to which a correction factor is applied to convert the calculations to the appropriate three-dimensional case. The pressures and forces on circular and square sectioned fuselages and on wings are calculated for hovering flight and also the corresponding changes of lift on the blade. It is shown that large changes of blade lift occur if the blade is close to a fuselage due to interference by the fuselage of the downwash or normal component of flow. The calculations also show that the interference effects on, and due to, a square sectioned fuselage are about half as large again as those of a circular cylinder whose diameter is the same as the length of the side of the square. The analysis is extended to the case of interference between a blade and a lifting wing or tailfin in forward flight. It is shown that the interference between a tailfin and tailrotor may result in a large loss of effectiveness of the tailrotor. Author

N67-28159 Royal Aircraft Establishment, Farnborough (England).
THE SUBCRITICAL RESPONSE AND FLUTTER OF A SWEPT-WING MODEL
C. A. K. Irwin and P. R. Guyett Aug. 1965 49 p refs
(RAE-TR-65186) CFSTI: $3.00

The dampings and frequencies of the lower natural modes of oscillation of an aeroelastic, swept-wing model at wind speeds below its critical flutter speed were deduced from measurements of the displacement-vector response of the model under sustained

excitation. The flutter speed and frequency were also measured. The tests were done in a wind tunnel at low subsonic speeds. Calculations were made for comparison with the experimental results. Good agreement was obtained between the measured and calculated flutter speeds and frequencies, but the agreement on the response at subcritical speeds was less satisfactory. Turbulence in the wind tunnel led to difficulties in taking measurements, and comments are given on these and other problems that arise in determining response characteristics. The model was of a novel construction and its features are described. Author

N67-28160 Aeronautical Research Council (Gt. Brit.)
WIND TUNNEL MEASUREMENTS OF THE EFFECT OF A JET ON THE TIME AVERAGE AND UNSTEADY PRESSURES ON THE BASE OF A BLUFF AFTERBODY
J. E. Rossiter and A. G. Kurn London, HMSO, 1967 36 p refs Supersedes RAE-TR-65187; ARC-27495; See X66-13372
(ARC-CP-903; RAE-TR-65187; ARC-27495) CFSTI: $3.00

Time average and unsteady pressures were measured on the base of a bluff afterbody, containing a single jet, in subsonic and transonic airstreams. Schlieren flash photographs were used to investigate the mixing process. It was found that over much of the range of investigation, the mixing of the jet with the external stream was dominated by a vortex motion analogous to the vortex street which occurs behind a bluff two dimensional body. This vortex shedding caused pressure fluctuations on the base of the model and had a significant effect on the time average base pressure. Author

N67-28171 Aeronautical Research Council (Gt. Brit.).
MEASUREMENTS OF PRESSURE DISTRIBUTION AND SHOCK-WAVE SHAPE ON POWER-LAW BODIES AT A MACH NUMBER OF 6.85
D. H. Peckham London, HMSO, 1967 32 p refs Supersedes RAE-TR-65075; ARC-27084; see N66-19505
(ARC-CP-871; RAE-TR-65075; ARC-27084) CFSTI: $3.00

Experiments on a family of power-law body shapes, $y \alpha x^n$, at a Mach number of 6.85 showed that for bodies of given fineness-ratio, minimum pressure drag is obtained at a value of the exponent n of about 0.7, the drag being approximately 20% less than that of a cone of the same fineness-ratio. Comparisons of the experimental pressure distributions with values calculated from approximate theories, strictly applicable only at $M_\infty = \infty$ and $\gamma \to 1$, were made. It was concluded that for low hypersonic Mach numbers (M_∞ 7) a more fundamental understanding of the flow field is required before reliable estimates of the pressure distributions on such body shapes can be obtained. Author

N67-28172# Aeronautical Research Council (Gt. Brit.).
SIX-COMPONENT LOW-SPEED TUNNEL TESTS OF JET-FLAP COMPLETE MODELS WITH VARIATION OF ASPECT RATIO, DIHEDRAL, AND SWEEPBACK, INCLUDING THE INFLUENCE OF GROUND PROXIMITY
S. F. J. Butler, M. B. Guyett, and B. A. Moy London, HMSO, 1967 67 p refs Supersedes RAE-AERO-2652; ARC-23432; see X65-82898
(ARC-R&M-3441; RAE-AERO-2652; ARC-23432) CFSTI: HC $3.00/MF $0.65

To investigate the basic aerodynamic characteristics of jet-flap aircraft, six-component force and moment measurements have been made on jet-flap complete models in the R.A.E. No. 2 11.5 ft×8.5 ft low speed wind tunnel. The tests covered the effects produced by variations of wing aspect ratio, dihedral, and sweepback, and by ground proximity, on longitudinal and lateral static stability. Some of the more significant results outside ground influence include the high stalling incidence and $C_{L_{max}}$ values possible with a thick, heavily cambered jet-flap wing and the unexpected effects of the jet-flap on lateral static stability. Proximity to the ground produced appreciable changes in downwash at the tailplane as soon as the jet sheet neared the ground, and caused large reductions in lift and stalling incidence once jet impingement occurred. Author

N67-28289* International Information, Inc., Philadelphia, Pa.
DETERMINATION OF MOMENTA AND FORCES ACTING ON BODIES OF REVOLUTION IN A FREE-MOLECULAR STREAM AND IN A LUMINOUS FLUX [OPREDELENIYE MOMENTOV I SIL, DEYSTVUYUSHCHIKH NA VRASHCHAYUSHCHIYESYA TELA V SVOBODNOMOLEKULYARNOM POTOKE I V POTOKE SVETA]
V. S. Galkin Washington, NASA, Feb. 1967 7 p refs Transl. into ENGLISH from Inzh. Zh. (Moscow), v. 5, no. 5, 1965 p 954–958
(Contract NASw-1499)
(NASA-TT-F-10759) CSCL 01A

The author obtained formulas in the Shrello approximation, for momenta characteristics of axisymmetric bodies rotating in a hypersonic free-molecular stream. Formulas are also presented for forces and momenta acting on a nonrotating hemisphere at an angle-of-attack in a hypersonic free-molecular stream and, on the basis of an optical analogy, in a luminous flux. Author

N67-28293*# International Information, Inc., Philadelphia, Pa.
NONLINEAR THEORY OF WINGS OF SMALL ASPECT RATIO [K NELINEYNOY TEORII KRYL'YEV MALYKH UDLINENIY]
S. D. Yermolenko Washington, NASA, Jun. 1967 14 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Aivats. Tekh. (Kazan), v. 9, no. 2, 1966 p 9–18
(Contract NASw-1499)
(NASA-TT-F-10915) CSCL 01A

A nonlinear theory accounting for the variation in the wedging angle and free vortex ratio as a function of angle of attack and Mach number for small aspect-ratio wings is proposed. The basis of the method is the vortex system and the assumption that best reflects the physical picture of the airflow past a wing considered to be a flat rectangular plate in a uniform gas stream. For calculation purposes the wing is replaced by a vortex surface divided into m equal panels. The formulae developed are given and discussed. The results obtained by the method proposed agree closely with experimental data for a wide range of Mach number and angle of attack for both large and small aspect ratios. Practical results are achievable for m=2. Author

N67-28399# Ballistic Research Labs., Aberdeen Proving Ground, Md.
FORCE TESTS OF THE HYPERSONIC BALLISTIC STANDARD MODELS HB-1 AND HB-2
Klaus O. Opalka Jul. 1966 42 p refs
(BRL-MR-1798; AD-649254) CFSTI: HC $3.00/MF $0.65

Wind tunnel force tests were performed to determine the aerodynamic characteristics of the hypersonic standard models. Force and static stability parameters were determined at Mach numbers 2, 3, 4, 5, 6, 7.5 and 9.2 at constant Reynolds numbers. The results were compared with those from similar tests of these models in other wind tunnel facilities, and a very good correlation was found. Author (TAB)

N67-28513# RAND Corp., Washington, D. C.
AERODYNAMIC ASPECTS OF FUTURE SPACE VEHICLES AND IMPLICATIONS FOR TESTING
F. S. Nyland Mar. 1967 21 p refs
(P-3559; AD-649512) CFSTI: HC $3.00/MF $0.65

The paper treats some of the technical characteristics of lifting spacecraft and considers some problems of testing. Some general observations about operating lifting spacecraft in the

'atmospheres' of other planets were included in the hope of stimulating thought and discussion of such future possibilities. Author (TAB)

N67-28666 Deutsche Forschungsanstalt für Luft- und Raumfahrt, Brunswick (West Germany). Institut fuer Aerodynamik.
FLOW INVESTIGATIONS ON SWEPT COMPRESSOR CASCADES AT SUBSONIC MACH NUMBERS [STROEMUNGSUNTERSUCHUNGEN AN GEPFEILTEN VERDICHTERGITTERN BEI KOMPRESSIBLER UNTERSCHALLSTROEMUNG]
U. Stark Jan. 1967 68 p refs In GERMAN; ENGLISH summary
(DLR-FB-67-09; Rept.-65/43)

The results of experimental investigations on swept compressor cascades at high subsonic Mach numbers are presented. In order to determine the aerodynamic behaviour of swept compressor cascades, measurements of pressure loss coefficients, turning angles and pressure rise coefficients have been carried out with a straight and two swept compressor cascades with sweep angles of $\zeta = 20$ deg and $\zeta = 40$ deg in the high-speed cascade wind tunnel. These wake measurements at mid-span position show the fundamental influence of the sweep on compressor cascade performance, which consists in a decrease of the turning angles and pressure rise coefficients and in an increase of the critical Mach number. Measurements of blade-surface pressure distributions in several wall-parallel sections show that depending on the sweep angle ζ the effective inlet angles and the blade-surface pressure distribution of these sections are influenced by the tunnel side-walls. Author

N67-28668# Deutsche Versuchsanstalt für Luft- und Raumfahrt, Porz (West Germany). Institut fuer Angewandte Gasdynamik.
THE PERTURBATION VELOCITIES IN THE CHORDWISE AND SPANWISE DIRECTION FOR THIN RECTANGULAR WINGS OF LOW ASPECT RATIO WITHOUT LIFT IN COMPRESSIBLE SUBSONIC FLOW [DIE STOERGESCHWINDIGKEITEN IN STROEMUNGS- UND SPANNWEITENRICHTUNG FUER DUENNE RECHTECKFLUEGEL KLEINER STRECKUNG OHNE AUFTRIEB IN KOMPRESSIBLER UNTERSCHALLSTROEMUNG]
Horant Krueger Mar. 1967 32 p refs In GERMAN; ENGLISH summary
(DLR-FB-67-18; DVL-632) CFSTI: HC $3.00/MF $0.65

The components of perturbation velocity viewed in chordwise direction and perpendicular to the longitudinal axis are computed for three rectangular wings of low aspect ratio. These wings are different in their thickness distributions in chord- and spanwise direction. The source distrioution is proportional to the first derivative of the thickness distribution on the assumption that the wings are thin. The effects of the thickness distributions relative to the induced velocities are represented by lines of constant velocity. Especially the influence of the induced flow in spanwise direction is not negligible. Moreover the position of the stagnation point in front of the rectangular source distribution is determined as a function of the aspect ratio. Author

N67-28692# Naval Ordnance Lab., White Oak, Md.
FEASIBILITY STUDY OF THE DETERMINATION OF SHOCK DETACHMENT DISTANCE AND ABLATION ON LUMINOUS BODIES USING A LASER LIGHT SOURCE
John L. Lankford 1 Feb. 1967 34 p refs
(NOLTR-67-18; Ballistics Res. Rept.-170; AD-650875) CFSTI: HC $3.00/MF $0.65

A laser light source was employed in a shadowgraph system in a 1000-foot hyperballistics range to investigate new techniques for observing the shock shape, detachment distance, and nose shape for luminous and ablating models at hypersonic speeds. Film fogging and distortion, usually present when the aerodynamic heating at high velocities causes ablation and luminosity at the nose of the model, were markedly reduced, using a selective focusing technique and a Q-switched ruby laser light source. Shock detachment distances measured directly from film plates compare well with the results from previous indirect techniques that are not applicable to luminous or ablating bodies. The method described shows promise for application to the study of model recession under simulated re-entry conditions and for investigation of the relation of model shape changes to ablation, shock shape, and shock detachment distance. Author (TAB)

N67-28804# Technische Hochschule Aachen (West Germany). Institut fuer Strahlantriebe und Turboarbeitsmaschinen.
STRESS ANALYSES OF RADIAL FLOW IMPELLER WHEELS [FESTIGKEITSUNTERSUCHUNGEN AN RADIAL DURCHSTROEMTEN LAUFRAEDERN]
W. Soetebeer [1966] 13 p In GERMAN; ENGLISH summary
Presented at the Ann. Joint Meeting DGRR/WGLR, Bad Godesberg, W. Germany, Oct. 1966 *Its* Meeting Paper No. 66–119
CFSTI: HC $3.00/MF $0.65

It is the object of the stress analyses to find a suitable method of calculation that would take into account with sufficient accuracy the complicated geometric designs characterising, for instance, centrifugal flow impeller wheels. The theoretical calculations differ from the conventional methods of calculation used for symmetrical discs and must be supplemented by experiments in order to check the accuracy of calculation. For such experimental examinations, a test stand was developed to carry out by a suitable measuring method quasistatic measurements on rotating models with the aid of strain gages. The measuring system and the measuring device are being explained, and it is shown that the magnitude of measuring errors can be kept within very small limits by the selected system of transmitting the test data. Author (ESRO)

N67-28924# Royal Aircraft Establishment, Farnborough (England).
CALCULATION OF THE LOAD DISTRIBUTION, AT SUPERSONIC SPEEDS, ON A SWEPTBACK WING OF ARBITRARY PLANFORM
G. M. Roper Nov. 1966 57 p refs
(RAE-TR-66356) CFSTI: HC $3.00/MF $0.65

A method for calculating the load distribution on a cambered or uncambered sweptback wing, with subsonic leading edges and supersonic or subsonic trailing edges, is described. Evvard's method is used for the part of the wing ahead of the trailing edge disturbances, and a lift cancellation method for the part affected by the wake. The formulae derived are put into forms suitable for calculations on a high-speed digital computer. Author (ESRO)

02 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

N67-27799# Royal Aircraft Establishment, Farnborough (England).
FREE-FLIGHT MODEL MEASUREMENTS OF THE DYNAMIC STABILITY OF A SUPERSONIC STRIKE AIRCRAFT (ITSR2)
G. K. Hunt Nov. 1965 84 p refs
(RAE-TR-65253) CFSTI: HC $3.00/MF $0.65 (Declassified)

Longitudinal and lateral stability derivatives were obtained in free flight from eight 1/12-scale models of the TSR2, at Mach

numbers between 0.7 and 1.4 and Reynolds numbers between 7 and 15 million. The measurements indicate some loss of longitudinal and lateral stability at transonic speeds, and the loss of yaw stiffness n_v is shown to be dependent on C_L. At supersonic speeds the sideslip derivatives l_v, n_v, and y_v diminish continuously with increasing Mach number. The aerodynamic effects of a sudden engine failure were produced at M=1.3 on two models, but the response was negligible. The sideslip derivatives n_v and y_v were considerably reduced at transonic speeds by flying with a simulated idle engine. Four of the models autorotated after lateral disturbances. Some of the characteristics of this behavior have been determined from the flight records and by simulating the motion on an analogue computer. Author

N67-27819 Brussels Univ. (Belgium). Institut de Mecanique Appliquée.
CHARACTERISTICS OF THE ELEMENTS OF THE PV-1 EXPERIMENTAL AIR CUSHION, PART 2 [CARACTERISTIQUE DES ELEMENTS DUE VEHICULE EXPERIMENTAL A COUSSIN D'AIR PV-1, 2EME PARTIE]
A. Jaumotte, A. Kiedrzynski, and M. Lejeune 1966 44 p refs In FRENCH
(Contract DRME-65-34079-00-480-75-01)
(NT-8-1966)

Air speed and pressure distribution measurements were compared with theoretical figures, in an investigation of an air cushion experimental vehicle characteristics. Then a calculation was made of charge loes. When energy balance and propulsion efficiency of the jet were considered, it was found that propulsion by jet deviation did not give the power desired. Transl. by R.U.

N67-27990# Southampton Univ. (England).
HELICOPTER BLADE SLAP
F. Webb Taylor *In* Army Dept. Proc. of the 1966 Army Sci. Conf., Vol. II 26 Aug. 1966 p 381–395 refs (See N67-27971 15-34)
(AD-634644)

The possible mechanism for the generation of helicopter blade slap was studied theoretically and by use of a test rig on which blade slap was simulated. It was found that the observed noise is dependent on the fourth power of the velocity and the square of the vortex strength. Since noise increased with the square of the vortex velocity amplitude, highly loaded rotor blades produced louder blade slap. G.G.

N67-28153 Royal Aircraft Establishment, Farnborough (England).
SONIC BANG INTENSITIES IN A STRATIFIED, STILL ATMOSPHERE
D. G. Randall Jan. 1966 34 p refs
(RAE-TR-66002) CFSTI: $3.00

Formulas for sonic bang intensities in stratified atmospheres are obtained by a combination of geometrical acoustics and the standard procedure for modifying linear theory predictions to take account of non-linear effects. Results are obtained for an aircraft flying at constant velocity and altitude in an atmosphere where the speed of sound decreases linearly from the ground to a certain altitude and then stays constant. Author (TAB)

N67-28180 Aeronautical Research Council (Gt. Brit.).
TESTS ON A HUNTER F.2 OF TWO STRAIN GAUGE METHODS FOR MEASURING TAILPLANE LOADS IN FLIGHT, WITH SOME LOADS MEASURED IN LEVEL FLIGHT, PITCH-UPS AND TRANSONIC DIVES
O. P. Nicholas London, HMSO, 1964 61 p refs Supersedes RAE-TN-AERO-2886; ARC-25000
(ARC-CP-754; RAE-TN-AERO-2886; ARC-25000) CFSTI: $3.00

The methods for measuring tailplane loads were tested in flight on a Hunter F-2 aircraft. One method used modified tailplane mountings which provided a satisfactory means of checking, in flight, the datums of their strain gauge bridges. Although hysteresis and other non-linearities in the load calibrations, together with fairly rapid temperature drift, limited the measuring system's usefulness in the flight tests, it appears that, with refinements in design, it should offer a good method for measuring absolute tail loads. The second measuring system, using shear strain gauges attached to the fuselage sides ahead of the tailplane, gave suitable load calibrations but was subject to considerable temperature drift. Reasonable agreement was obtained between the two systems, on incremental changes in aerodynamic load, over short time intervals (less than 30 sec). In all cases the maximum loads measured were well below the structural strength limitations of the aircraft. Author

N67-28183# Air Force Systems Command, Wright-Patterson AFB, Ohio. Systems Engineering Group.
EVALUATION OF RAIN-EROSION-RESISTANT MATERIALS TO PROTECT THE HW-43B/F HELICOPTER ROTOR Technical Report, 30 Jul. 1963–26 Dec. 1964
Matthew H. Chopin Aug. 1966 46 p refs
(SEG-TR-65-53; AD-649258) CFSTI: HC $3.00/MF $0.65

The report describes the tests of various materials to determine a suitable protective covering for the HH-43B/F helicopter servo-flap leading edge when operating in rain. Nineteen materials were tested and compared on a rain erosion spray rig in the electric motor whirl stand facility at WPAFB Ohio. Impact velocity varied from 330 to 730 ft per second. A description of the facility, test procedures, results and recommendations is presented. Photographs of the spray rig and test specimens are also included. Author (TAB)

N67-28287* Holman (John F.) and Co., Inc., Washington, D. C.
SOME AERODYNAMIC PROBLEMS RELATED TO THE PROPULSION OF A HYPERSONIC AIRCRAFT [QUELQUES PROBLEMES AERODYNAMIQUES LIES A LA PROPULSION D'UN AVION HYPERSONIQUE]
Jean-Pierre Bourgeois and Fabien Chiche Washington, NASA, May 1967 52 p refs Transl. into ENGLISH from the French Presented at the 3d Meeting of the Assoc. Franc. Ingr. Techniciens de l'Aeronautique et de l'Espace, Colloq. of Appl. Aerodyn., Marseille, 8–10 Nov. 1966
(Contract NASw-1495)
(NASA-TT-F-10944; ONERA-TP-416) CSCL 01C

The air-intakes and the exhaust nozzles of ramjet power plants on a hypersonic aircraft will be large when compared to the wing or to the fuselage and they will have a dominant effect on the overall aircraft configuration. Following a general presentation of some important parameters, the following topics are discussed: a. initial compression under the lower surface of the delta-wing at a given angle-of-attack at hypersonic speed, b. efficiency of an external–internal supersonic compression, two-dimensional air-intake adapted to a subsonic combustion chamber, c. two-dimensional exhaust nozzles; the jet expansion calculations were carried out assuming firstly that the gas is perfect ($\gamma = 1.4$) and secondly that the gases are real (variable γ) in both cases; equilibrium and frozen flows. The study deals with the adaptation of the nozzle to a cruising Mach number and with the forces due to the propulsive jet (thrust, lift and pitching moment). Author

N67-28369*# Boeing Co., Morton, Pa.
FEASIBILITY OF V/STOL CONCEPTS FOR SHORT-HAUL TRANSPORT AIRCRAFT
Bernard L. Fry and Joseph M. Zabinsky Washington, NASA, May 1967 181 p refs
(Contract NAS2-3142)
(NASA-CR-743) CFSTI: HC $3.00 CSCL 01C

The results of a study of VTOL and STOL short-haul transports are presented. Five VTOL and two STOL aircraft were analyzed to

determine those most suitable for commercial short-haul operation and the research required to bring them to full operational status. The VTOL concepts studied were the tilt wing, jet lift, stowed-rotor helicopter, and tip-turbine lift fan aircraft. The STOL types were the fan-in-wing and the high-lift turbofan. The study covered airplane design, operational techniques, noise and public acceptance, acquisition cost, direct operating cost, technical risk, and research requirements. The results of the study show that the turbofan STOL, tilt-wing VTOL, lift-fan VTOL, and jet-lift VTOL are the most promising concepts. Furthermore, if solutions can be found to the noise-suppression problem for the jet-propulsion types, they can all be brought to operational status in the 1970 to 1975 time period. The direct operating costs of V/STOL aircraft are potentially no higher than those of conventional short-haul jet aircraft over 500 mile stage lengths, and will be lower than the operating costs of present turbine helicopters for very short trips down to 25 miles. Author

N67-28603# National Engineering Science Co., Pasadena, Calif.
DYNAMIC ANALYSIS OF THE TETHERING CABLE PORTION OF A HIGH ALTITUDE TETHERED BALLOON SYSTEM UNDER FULLY DEPLOYED CONDITIONS Final Report
A. Soldate Oct. 1966 94 p refs
(Contract N00014-66-C0187; ARPA Order 756)
(S-344; AD-651024) CFSTI: HC $3.00/MF $0.65

A computer study has been made of nonsteady aerodynamic loadings on a long, cylindrical cable of the continuous glass fiber–resin type used as a tether for a balloon at altitudes of approximately 100,000 feet. No important interactions between torsional, longitudinal, and lateral modes were found. Furthermore, the effects of lateral loadings from gusts or vortex sheddings were found to be unimportant. Computer programs are presented that enable computations to be made of cable motions resulting from localized gust loadings and from vortex shedding phenomena. Author (TAB)

N67-28674 Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Stuttgart (West Germany). Abteilung Flugmechanik der Vertikal Start Flugzeuge.
HELICOPTER CONTROL AND STABILITY. PART III: LONGITUDINAL MOTION [STEUERUNG UND STABILITAET VON DREHFLUEGEL-FLUGZEUGEN. TEIL III: LAENGSBEWEGUNG]
W. Just Oct. 1966 310 p refs In GERMAN; ENGLISH summary
(DLR-FB-66-75; Rept.-57)

For the theories of pitching: longitudinal velocity and pitching; longitudinal velocity, normal velocity, and pitching, regarding also the additional degrees of freedom of the flapping motion and the rotation about the rotor axis, the equations of motion are arranged, and solved. A description of the computation of stability derivatives is presented. Further chapters deal with handling qualities criteria, time histories of motion, transfer functions, frequency responses, flight measurements, and stability and control at high speeds. Author

N67-28682# RAND Corp., Santa Monica, Calif.
DAPCA: A COMPUTER PROGRAM FOR DETERMINING AIRCRAFT DEVELOPMENT AND PRODUCTION COSTS
H. E. Boren, Jr. Feb. 1967 89 p refs
(Contract F44620-67-C-0045; Proj. (RAND)
(RM-5221-PR; AD-650560) CFSTI: HC $3.00/MF $0.65

The memorandum presents a description of a computer program (DAPCA) developed to compute development and production costs for the major subsystems (i.e., airframes, engines, and avionics) of flyaway aircraft. This program is based on the methodologies described in RM-4585-PR, RM-4670-PR (abridged) (AD-624 094), and RM-4851-PR (abridged) (AD-633 636). Author (TAB)

N67-28712# Deutsche Forschungsanstalt fur Luft- und Raumfahrt, Brunswick (West Germany).
NEW RESEARCH WORK OF THE FLIGHT SAFETY FOUNDATION IN THE FIELD OF FLIGHT SAFETY [NEUE FORSCHUNGSARBEITEN DER FLIGHT SAFETY FOUNDATION (FSF) AUF DEM GABIET DER FLUGSICHERHEIT]
H. Herb Jan. 1967 50 p refs In GERMAN; ENGLISH summary
(DLR-MITT.-67-02)

World-wide aircraft safety and accident statistics are analyzed for trends, causes, and developments connected with the introduction of new-type aircraft. A discussion of accident causes includes human factors, atmospheric phenomena, weather, and collision with birds as well as such technical causes as structural failure, material fatigue, and fire hazard. Problems expected to be encountered with the introduction of supersonic transport aircraft are summarized. Transl. by K.W.

N67-28753*# Sperry Phoenix Co., Ariz.
AVIONICS REQUIREMENTS FOR ALL WEATHER LANDING OF ADVANCED SST'S. VOLUME I: ANALYSIS OF SYSTEM CONCEPTS AND OPERATIONAL PROBLEMS Final Report
S. S. Osder Apr. 1967 119 p refs
(Contract NAS2-4124)
(NASA-CR-73092) CFSTI: HC $3.00/MF $0.65 CSCL 01B

Reviewed are technical and operational problems of all weather landing (AWL), with the focus on those aspects that are amenable to solution by progress in avionics concepts and equipment. The present status of AWL activity is analyzed and projected into the era of the supersonic transport (SST). It is shown that many different systems associated with various equipment and aircraft manufacturers are essentially identical except for details of mechanization. In addition to progress in avionics, improvements in runways are also considered. The unique characteristics of the SST's primary flight controls and its handling qualities are described. Various concepts of integrated avionics based on central digital computers or small autonomous but interconnected computers are examined. The relationship between the AWL subsystems and other subsystems of the large avionics complex is explored. The probable form of the AWL avionics that will be needed for aircraft in the 1985 era is outlined. K.W.

N67-28767*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LOW-SPEED TESTS OF AN ALL-FLEXIBLE PARAWING FOR LANDING A LIFTING BODY SPACECRAFT
Frank M. Bugg and William C. Sleeman, Jr. Washington, NASA, Jun. 1967 18 p refs
(NASA-TN-D-4010) CFSTI: HC $3.00/MF $0.65 CSCL 01A

Wind-tunnel and flight investigations were made to determine the static longitudinal aerodynamic characteristics and flight-rigging requirements for an all-flexible parawing. The maximum lift-drag ratio measured in the wind-tunnel tests of the parawing and lifting-body combination was approximately 2.5 and the maximum lift coefficient obtained was about 0.96. The highest lift-drag ratio, about 2.7, was obtained with a longitudinal spread of the rigging attachment points at the payload. Pitching-moment results indicated that the wing-body configuration was stable over the test angle-of-attack range for the assumed moment reference except at the lowest test dynamic pressure, where longitudinal instability occurred at high angles. For longitudinal control by center-of-gravity shift, a capability of shifting the center of gravity relative to the wing by a distance of 4.2% of the body length would allow the parawing-body configuration to be trimmed at any point in its usable lift-coefficient range. Free-flight tests indicated that the change in length of the three rear lines required to trim the model over its usable lift-coefficient range was about 5% of the keel length. In flight tests with a point confluence attachment of the lines, directional alinement characteristics of the body with respect to

the wing were unsatisfactory. A modified rigging attachment was found to give very good directional alinement. Author

N67-28794*# Sperry Phoenix Co., Ariz.
AVIONICS REQUIREMENTS FOR ALL WEATHER LANDING OF ADVANCED SST'S. VOLUME III: SPECIFIC PROBLEMS OF AN SST AND RELATED TECHNOLOGICAL TRENDS
Final Report
S. S. Osder Apr. 1967 85 p refs
(Contract NAS2-4124)
(NASA-CR-73094) CFSTI: HC $3.00/MF $0.65 CSCL 01B

Handling qualities for all weather landing, electronic flight control system configurations, and integrated digital avionics are discussed. Details are given on the criteria of handling qualities, and on the longitudinal and lateral handling qualities. It is recommended that the SST incorporate a command augmentation system, direct lift control, full-time fail-operational yaw and roll dampers, and full-time lateral dampers. The electronic flight control configurations encompass the functions of stability augmentation, autopilot including autopilot control and flight directory display computation, and electronic command providing manual control computation. It is shown that the control configurations and overall control system complexity and reliability are determined to a great extent by the basic manual control system configuration. The advantages of a digital over an analog system are described. The instrumentation, concepts, and data flow in an integrated digital system are discussed for automated all weather landing. N.E.N.

N67-28878# Advisory Group for Aerospace Research and Development, Paris (France).
A NOTE ON ROTARY HIGH HOVERING AND TAKE-OFF PERFORMANCE, DATA ACQUISITION AND ANALYSIS
J. C. Kidwell Oct. 1966 17 p Presented at the 27th Meeting of the AGARD Flight Mech. Panel, Rome, 11–12 Oct. 1966
(AGARD-517) CFSTI: HC $3.00/MF $0.65

The paper describes the test and data-analysis techniques used for helicopter hovering and take-off performance investigations at Edwards Air Force Base, where the tethered hovering technique was developed. It is concluded that the methods outlined produce data suitable for defining helicopter hovering and take-off performance. The resulting data has been proven to be repeatable and of sufficient accuracy to provide a basis for Flight Manual Performance Charts. The methods minimize the testing required and provide accuracy that cannot be attained by extrapolation or calculation. Author

N67-28879# Advisory Group for Aerospace Research and Development, Paris (France).
APPLICATION OF THE MODEL TECHNIQUE TO A VARIABLE-STABILITY HELICOPTER FOR SIMULATION OF VTOL HANDLING QUALITIES
J. F. Garren, Jr. and J. R. Kelly Oct. 1966 24 p refs Presented at the 27th Meeting of the AGARD Flight Mech. Panel, Rome, 11–12 Oct. 1966
(AGARD-515) CFSTI: HC $3.00/MF $0.65

In order to provide a means for accurate in-flight simulation of V/STOL aircraft, a computer model technique has been adapted to a variable-stability helicopter. Unlike the stability-derivative simulation technique, which is usually employed in variable-stability aircraft, the model approach produces a response which is essentially independent of the dynamics of the test vehicle. The aircraft response, therefore, is a function only of the evaluation pilot's control inputs and the dynamics which are programed into the analog computing equipment. In-flight time histories of the helicopter response and the corresponding commanded response are presented to illustrate the effectiveness of the technique. The results indicate that the model technique does, in fact, provide a feasible, accurate, and flexible approach to in-flight simulation. Author

N67-28888# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE DYNAMICS OF FLIGHT STABILITY AND CONTROLLABILITY OF FLYING VEHICLES
I. V. Ostoslavskiy and I. V. Strazheva 12 Dec. 1966 700 p refs Transl. into ENGLISH of the book "Dinamika Poleta Ustoychivosti' i Upravlyayemost' Letatel'nykh Apparatov" Moscow, Izd. Mashinostr., 1965 467 p
(FTD-HT-66-282; TT-67-61394; AD-649421) CFSTI: HC $3.00/MF $0.65

The book is devoted to the theory of stability and controllability of flying vehicles. The stability and controllability of winged flying vehicles is the basic subject for a wide range of velocities, including supersonic velocities. The book discusses contemporary methods of investigating stability and controllability in longitudinal and lateral motions, on takeoff and landing and in critical angles of attack. The transfer functions for a flying vehicle are considered, as are the methods for selecting optimum vehicle and automation parameters. In addition to the mathematical foundations of the studies, engineering methods for the computation of stability and controllability with numerical examples are presented. Author (TAB)

N67-28891# Federal Aviation Agency, Washington, D. C. Economics Div.
GENERAL AVIATION: A STUDY AND FORECAST OF THE FLEET AND ITS USE IN 1975
Jul. 1966 135 p refs
(AD-649338) CFSTI: HC $3.00/MF $0.65

A detailed examination has been made of general aviation flying between the years 1954 and 1964. Based on this examination and the outlook for the industry, a forecast has been made for the year 1975. Such a forecast is required as a guide to the long-range planning necessary to enable the Federal Aviation Agency to meet its responsibilities for the establishment and operation of a safe and adequate airway system for all potential users - military, air carrier, and general aviation. TAB

03 AUXILIARY SYSTEMS

Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines; hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems.

N67-27956# Army Engineer Research and Development Labs., Fort Belvoir, Va. Electrical Power Div.
A HYDROCARBON-AIR FUEL CELL USING AN ACID ELECTROLYTE
Galen R. Frysinger *In* Army Dept. Proc. of the 1966 Army Sci. Conf., Vol. I 26 Aug. 1966 p 279–289 (See N67-27941 15-34)
(AD-634677)

Electrode processes are described for a new fuel cell concept that uses phosphoric acid electrolytes and offers the advantage of a highly compact fuel cell assembly that can be placed in a simplified system for the generation of dc electrical power from hydrocarbon fuels. The hydrocarbon can be reacted directly at the electrodes in an anodic oxidation reaction, or the active hydrogen of the hydrocarbon molecule can be liberated by a hydrocarbon-steam-reforming reaction and the hydrogen subsequently reacted at the fuel cell anode. A hydrocarbon-air fuel cell system is described that provides a portable electrical power supply in the kilowatt range with very low noise level and overall efficiency greater than 30%. Standard gasoline-type hydrocarbon fuels are used, and the system has a weight and volume comparable with existing engine generator power sources. M.W.R.

N67-27977# Army Electronics Labs., Fort Monmouth, N. J. Inst. for Exploratory Research.

A RECHARGEABLE THIN-FILM SOLID-ELECTROLYTE BATTERY

J. N. Mrgudich, P. J. Bramhall, and C. M. Schwartz *In* Army Dept. Proc. of the 1966 Army Sci. Conf., Vol. II 26 Aug. 1966 p 127–139 refs (See N67-27971 15-34)
(AD-634626)

An array of dime-sized pellets of AgI carrying evaporated films of silver and platinum on opposite faces were studied for their battery like behavior. Initial open circuit voltage of about 0.35 volt and a flash current of about 100 uA/cm^2 of cross sectional area was improved by using thinner pellets in the array. Compressed AgI powder pellets of 0.025 cm thickness in Ag–AgI–Pt cells charged to 0.6 volt and exhibited flash currents of about 600–700 uA/cm^2. Discharged Ag–AgI–Pt cells also accepted recharge at nearly 100% coulombic efficiency. It was concluded that an Ag–AgI–Pt cell with very thick Ag and Pt films will act as a power source while a cell with very thin Ag and Pt films will act as a sensitive sensing device. G.G.

N67-28005* Allis-Chalmers Mfg. Co., Milwaukee, Wis.

WATER RECOVERY SUBSYSTEM, DEVELOPMENT PLAN

P. D. Hess 30 Nov. 1964 14 p
(Contract NAS8-2696)
(NASA-CR-83956) CSCL 10A

A water recovery subsystem modifying the fuel cell power supply system to a closed loop design is discussed. It receives the product water from the fuel cell assembly in the vapor state and provides for recovery, accumulation, storage, and release of the product as potable water for consumption. It consists of condenser, water storage, and control subassemblies. Operation of the system is discussed, and functions and requirements of the major valves are listed. Areas needing further study are cited, and a test plan is projected. S.P.

N67-28097# Eagle-Picher Co., Joplin, Mo. Couples Dept.

INVESTIGATIONS LEADING TO THE DESIGN AND DEVELOPMENT OF MAGNESIUM/MAGNESIUM PERCHLORATE BATTERIES Final Report, Nov. 1, 1965–Oct. 31, 1966

Earl B. Cupp Feb. 1967 85 p
(Contract DA-28-043-AMC-01763(E))
(ECOM-01763-F; Rept.-4; AD-649572) CFSTI: HC $3.00/MF $0.65

The report summarizes the significant accomplishments during the one (1) year of effort expended on the development of a feasible MnO2/Mg(C104)2/Mg battery for field radio applications. Details of cell construction and testing are presented. The second portion of the report (Fourth Quarterly Report) details the results of a full scale test program designed to measure the characteristics of the system under various environmental conditions. The report shows the system to be very stable with varying temperatures and capable of performing well in at least one of the field radio operational modes. Author (TAB)

N67-28132# Royal Aircraft Establishment, Farnborough (England).

A THREE-DIMENSIONAL DIGITAL ACQUISITION SIMULATION OF THE BLACK ARROW ATTITUDE CONTROL SYSTEM

C. H. Garnett and R. G. Langton Mar. 1966 20 p refs
(RAE-TR-66104) CFSTI: HC $3.00/MF $0.65

A description is given of a Mercury Autocode program for calculating the acquisition behavior of the Black Arrow Attitude Control System in three-dimensions. Account is taken of the effects of Euler torques and gimbal cross coupling. The program was used to confirm system stability; to determine suitable values of certain parameters; to find the maximum likely acquisition time and total impulse and to check system behavior with off-design-point accelerations. Author

N67-28161 Joint Publications Research Service, Washington, D. C.

HELIOTECHNOLOGY, NO. 5, 1966

4 Apr. 1967 70 p refs Transl. into ENGLISH of Geliotekhnika, Akad. Nauk Uz. SSR (Tashkent), no. 5, 1966 p 3–18, 26–47, 55–58, 71–76
(JPRS-40523; TT-67-31167) CFSTI: $3.00

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8. A FREON-EJECTOR SOLAR REFRIGERATOR A. Kakabayev and A. Davletov p 37–43 refs (See N67-28169 15-33)

9. DISTRIBUTION OF SOLAR ENERGY FLUX DENSITY IN BOUNDARY ZONE BETWEEN LIGHT AND SHADE A. Sh. Sharafi p 44–48 ref (See N67-28170 15-03)

N67-28162 Joint Publications Research Service, Washington, D. C.

METHOD OF COMPUTING INCIDENT RADIATION FLUX ON WALLS OF CAVITY SOLAR RECEIVER

V. I. Baranov and G. F. Muchnik *In its* Heliotechnol., No. 5, 1966 4 Apr. 1967 p 1–8 refs (See N67-28161 15-03)

A mathematical method of computing the radiation flux distribution over the walls of a cylindrical solar receiver is described. Expressions for the energy reflected by the annular mirror surface of the receiver; and for the flux density changes in three different regions of the receiver (cylindrical region, bottom part, and angular region) are given. A geometrical diagram of the problem is depicted. Also calculated were the energy distribution in the solar ray beam itself, and the flux density around the focal point of radiation collector (uniform Gaussian distribution of the ray was assumed). The computed results for flux densities are graphically shown, along with curves showing the change in flux density at a constant cavity length to diameter ratio with variable cavity diameters. L.S.

N67-28163 Joint Publications Research Service, Washington, D. C.
GEOMETRICAL INTERPRETATION OF MATHEMATICAL CALCULATION MODEL OF ENERGY DISTRIBUTION IN PARABOLOID FOCAL PLANE
A. V. Vartanyan *In its* Heliotechnol., No. 5, 1966 4 Apr. 1967 p 9–14 refs (See N67-28161 15-03)

A geometrical method of computing energy in the focal plane of a paraboloid in a collector-receiver system for the case of uniform energy distribution in the elementary reflected beam is examined. The beam energy distribution is divided into elements, solved element by element by integration, and the whole pattern of energy distribution in the focal plane at a given regulator position is derived by summing the curves. The method is also useful in solving problems associated with designing high temperature receivers in that part of the calculations involving irradiance of opaque cavity walls with regard to the condition of visibility, and for determining the concentrating capacity of noncircular (partial paraboloids). L.S.

N67-28164 Joint Publications Research Service, Washington, D. C.
THE CASSEGRAINIAN SYSTEM AND ITS MODIFICATIONS AS SOLAR ENERGY CONCENTRATORS
V. V. Novikov, V. K. Baranov, L. V. Vasil'yeva, and N. N. Protasov *In its* Heliotechnol., No. 5, 1966 4 Apr. 1967 p 15–18 Presented at the All-Union Conf. on Use of Solar Energy, Ashkhabad, USSR, 29 Oct. 1966 (See N67-28161 15-03)

The parameters of a Cassegrainian mirror system to be modified and used as a solar energy concentrator, were mathematically and graphically analyzed to clarify the basic laws making correct parameter selection possible. The computations resulted in determining the size of the solar image in the focal spot of the system as a function of the parameters of the elements comprising the system. The system showed a very high degree of energy concentration. When parameters are properly chosen, use of the parabola–parabola, parabola-plane mirror and parabola-polyzonal mirror optical systems leads to insignificant reduction in energy concentration by the optical system. With the selection of parameters giving maximum energy concentration the ratio of the mirror diameters exerts the greatest effect. Optimum aperture angles may vary in a certain range without significant lessening of concentration. L.S.

N67-28165 Joint Publications Research Service, Washington, D. C.
A REFLECTOR ON A POLYSTYRENE FOAM BASE
S. N. Vil'kova, I. A. Novikova, A. Gafurov, and G. Ya. Umarov *In its* Heliotechnol., No. 5, 1966 4 Apr. 1967 p 19–21 refs (See N67-28161 15-03)

Specific impact and compression strength data on compositions of polystyrene foam used as a substrate for a solar energy collector mirror surface, are presented. Various fillers; asbestos, glass fiber, capron fiber, and capron interlayers, were added to the polystyrene to raise its physical strength and to increase its heat resistance. The collector is to be used under the conditions of a hot Central Asian summer. The specimens were subjected to heat treatments, irradiation exposures, and light and weather exposures to determine how well the compositions stand up with respect to strength. L.S.

N67-28166 Joint Publications Research Service, Washington, D. C.
PROTECTION OF MIRROR SURFACES PRODUCED BY THE TRANSFER METHOD
S. N. Vil'kova, T. A. Driginkina, and G. Ya. Umarov *In its* Heliotechnol., No. 5, 1966 4 Apr. 1967 p 22–25 refs (See N67-28161 15-03)

Absorption spectra of the photostabilizers 2,2'-oxy-5-methyl-phenyl benzotriazole (tinuvin) and 2-oxy-4-methoxy-benzophenone, and of the lacquers nitrocellulose No. 951, nitrophenolformaldehyde No. 9-32N, and polyamide acrylic AS-528 were obtained in the ultraviolet for the purpose of determining the advisability of introducing the photostabilizers in the lacquers which are used to protect transfer aluminum mirrors. Data showing the dependence of the reflection coefficients of the lacquers with added photostabilizers after time exposures, are graphically depicted. The results are discussed, and generally indicate the feasibility of protecting transfer aluminum mirrors by lacquers containing photostabilizers. The polyamide acrylic lacquers appear to be most promising. L.S.

N67-28168 Joint Publications Research Service, Washington, D. C.
FEASIBLE TECHNICO-ECONOMIC CHARACTERISTICS OF DIFFERENT REGENERATIVE SOLAR THERMAL STILLS
V. A. Baum, R. Bayramov, and Ya. Atayev *In its* Heliotechnol., No. 5, 1966 4 Apr. 1967 p 31–36 refs Presented at the All-Union Conf. on Use of Solar Energy, Ashkhabad, USSR, 29 Oct. 1966 (See N67-28161 15-03)

The economic and technological characteristics of several regenerative solar stills driven by a solar thermal power station are described and compared to solar stills of the hotbed type. The cost calculations are based on energy comsumption per volume of water for given mirror areas. The data indicate that the solar thermal power station still is slightly superior to the simplest stills, but have even more pronounced advantages when very high powers are used. L.S.

N67-28170 Joint Publications Research Service, Washington, D. C.
DISTRIBUTION OF SOLAR ENERGY FLUX DENSITY IN BOUNDARY ZONE BETWEEN LIGHT AND SHADE
A. Sh. Sharafi *In its* Heliotechnol., No. 5, 1966 4 Apr. 1967 p 44–48 ref (See N67-28161 15-03)

Formulas are derived and used to determine the distribution of the solar energy flux density in the boundary zone between light and shade (in the penumbra of a screen and on the edge of a spot produced by a plane mirror) caused by the sun's rays. The derived formulas may be used to design various types of faceted collectors of solar energy and various types of automatic sun tracking devices; and may also be used to calculate energy distribution on the spot formed in the reflection of solar rays from unit areas of a solar collector including concentrators whose surfaces deviate from the ideal (taking mirror surface inaccuracies into account). L.S.

N67-28507# ARO, Inc., Arnold Air Force Station, Tenn.
INDUCTION POWER SUPPLY FOR A 100-IN. HOTSHOT WIND TUNNEL
J. N. Patterson Arnold Eng. Develop. Center, Mar. 1967 71 p refs (Contract AF 40(600)-1200)
(AEC-TR-66-260; AD-649376) CFSTI: HC $3.00/MF $0.65

The report describes a 100-million joule inductive power supply. A description of all major, or unique, components is presented. The supply furnishes energy primarily to a 100-inch, test section hotshot tunnel; however, other applications have been made since the initial operation. The system theory of operation is presented along with major operational problems that have developed during the five years the system has been in operation.
Author (TAB)

N67-28559# Ohio State Univ. Research Foundation, Columbus.
A STUDY OF A CORONA WIND DIGITAL FLUID AMPLIFIER ELEMENT
James L. Bishop and Henry R. Velkoff Mar. 1967 88 p refs (Contract DA-31-124-ARO(D)-246)
(AROD-4942.3-E; AD-651166) CFSTI: HC $3.00/MF $0.65

An experimental investigation was conducted on the use of corona wind in air as a means of triggering a fluid 'flip-flow' amplifier element. The study centered on the ability to miniaturize the device. Specific emphasis was also given to the nature of the connecting lines and plenum for the lateral control ports. The results of the investigation indicated that the miniaturized units required very small currents to flip the primary jet, and that the units were very sensitive to the configuration of the plenum and lateral lines. Author (TAB)

N67-28625# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MAGNETOHYDRODYNAMIC GENERATOR
V. N. Garbuzov, V. A. Parkhomenko, and V. Ye. Strizhak 5 Dec. 1966 7 p Transl. into ENGLISH from Russian Patent No. 175583 (Appl. No. 685696/26, 15 Nov. 1960) 7 p
(FTD-HT-66-602; AD-650802) CFSTI: HC $3.00/MF $0.65

A magnetohydrodynamic conduction-type generator that uses the Hall effect is described. The generator channel is constructed of alternating metal and insulating frames arranged at an angle to the generator axis to improve operational dependability of the generator. TAB

N67-28631# Yardney Electric Corp., New York.
DEVELOPMENT OF THE METAL–AIR BATTERY SYSTEM Final Report, 1 Jul. 1965–30 Sep. 1966
Ray Blossom Mar. 1967 56 p
(Contract DA-28-043-AMC-01614(E))
(ECOM-01614-5; Rept.-5; AD-650780) CFSTI: HC $3.00/MF $0.65

The goal of this contract was the development of a 32 volt - 10 watt primary metal-air battery with a specific energy in excess of WH/lb. The principal work was an investigation of zinc, magnesium, aluminum, calcium, and barium electrodes coupled with an air reducing cathode in aqueous electrolyte systems. This study included the discharge performance of the above cells at various current densities over a temperature range of -25F to +125F. During the fifth, and final, quarterly period the relationship between air supply and metal-air cell behavior was studied. Experimental air polarization data obtained from this study are given. From the heat transfer analysis of these data, a method of correlating cell pack temperature with the convective air flow rate was derived. Zinc-air gave best discharge performance over the current density and temperature range investigated. Of the group of cell systems studied, zinc-air was the only metal-air cell which met ECOM requirements for the 32 volt battery. Six 26 cell - 16 AH zinc-air batteries were fabricated. Construction and performance details are given. Author (TAB)

N67-28644*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SOLAR POWER GENERATION
In its Res. and Advanced Develop., Vol. II 31 Jan. 1967 p 45–93 refs (See N67-28641 15-34)

Technology is being developed for the design and fabrication of a high power 1250 ft^2 solar array exhibiting a minimum power density of 20 w/lb. Solar cell standards are being investigated to predict the space power output of solar arrays and to test newly developed photovoltaic devices and materials. A concept for deploying lightweight, large solar arrays is under study, and applied mechanics support is being provided for this effort. Capability of in-house experimentation to gather solar cell characteristic data in extreme temperature and solar intensity environments, the concept of rollup solar array technology, multikilowatt systems, and solar arrays suitable for use on landed planetary spacecraft are being studied. Other investigations deal with solar thermionic converters and generators, photovoltaic arrays and solar concentrators, mechanization of planetary spacecraft electrical power systems in the 100 to 400 w range, low input voltage circuit and microcircuit development, and a low saturation drop silicon transistor. M.W.R.

N67-28645*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
CHEMICAL POWER GENERATION
In its Res. and Advanced Develop., Vol. II 31 Jan. 1967 p 95–111 refs (See N67-28641 15-34)

Reaction geometry is being studied for the oxidation and reduction of the alkaline silver electrode, and for the chemical and electrochemical nature and behavior of electrodes. Under development is a heat-sterilizable impact-resistant battery capable of a 200 w-hr capacity, a Ni–Cd battery for backup energy storage, and a separator for a heat-sterilizable Ag–Zn battery. Battery activation and control techniques, effects of gravitational forces on battery performance, extent of damage to secondary Ag–Zn battery during storage and operation in radiative environments are under investigation. M.W.R.

N67-28771*# TRW Systems Group, Redondo Beach, Calif.
POWER SYSTEM CONFIGURATION STUDY AND RELIABILITY ANALYSIS Quarterly Progress Report, 7 Jan.–6 Apr. 1967
W. G. Binckley 6 Apr. 1967 70 p Prepared for JPL
(Contract NAS7-100; JPL-951574)
(NASA-CR-84816; E-7441.2-005; QPR-3) CFSTI: HC $3.00/MF $0.65 CSCL 10A

Methods of implementing component redundancy are described. Component parts counts, efficiency and weight data are included. A method for power system reliability–weight optimization and the results of initial optimization computer runs are described. Power system electromagnetic compatibility considerations are summarized. Author

N67-28773*# American Univ., Washington, D. C.
RESEARCH INTO FUNDAMENTAL PHENOMENA ASSOCIATED WITH SPACECRAFT ELECTROCHEMICAL DEVICES—CALORIMETRY OF NICKEL-CADMIUM CELLS Progress Report, 1 Oct. 1966–31 Dec. 1966
W. H. Webster and R. T. Foley Dec. 1966 37 p
(Contract NAS5-10105)
(NASA-CR-84809; PR-2) CFSTI: HC $3.00/MF $0.65 CSCL 10C

Investigations of the six ampere–hour nickel–cadmium cell with Adhydrode control electrode were concluded. These were: (1) cycling experiments (40% depth of discharge, 110% recharge), (2) charge efficiency studies, and (3) transducer study. The 40% depth represents the deepest discharge to which the cell had been subjected during these investigations. As expected, this 40% depth of discharge produced the greatest thermal effect, 1.18 watts and the maximum build-up of oxygen pressure. Enthalpy changes obtained from the thermal response for this experimental series remained in excellent agreement with the calculated theoretical value (33.1 kcal/equiv) for these reactions. During the efficiency studies the charge rate was varied from c/10 (0.06 amps) to c/1.2 (5.0 amps) resulting in only a slight variation in the efficiency. The average efficiency obtained was 83.6%. After the completion of 335 cyclic experiments the cell was removed from the calorimeter and fitted with a transducer for the purpose of correlating the Adhydrode signal with the oxygen pressure in the cell. Author

N67-28776*# Honeywell, Inc., Hopkins, Minn. Ordnance Div.
DEVELOPMENT OF MULTIPLE SOURCE—MULTIPLE LOW VOLTAGE CONVERTER-REGULATOR POWER SUPPLY WITH AUTOMATIC FAILURE SENSING AND REDUNDANT SWITCHING Quarterly Report, 30 Jun.–30 Sep. 1966

Kenneth J. Jenson 30 Sep. 1966 41 p refs
(Contract NAS5-10148)
(NASA-CR-84808; QR-1) CSCL 10B

Continuing research is reported in the development of high efficiency, high reliability low input voltage converter–regulator (LIVCR) systems by combining proven LIVCR configurations with newly developed techniques in the general area of automatic failure sensing and compensation. Details are given on the design, development, and initial testing of a pulse width modulated regulator drive and control circuit with automatic failure sensing and compensation features. The breadboard circuits tested proved the feasibility of automatically sensing failures and replacing system functions that have failed with functions that are operational. The design, fabrication, and initial testing of two alternative circuits for synchronizing four redundant LIVCs are described. The chief difference in the methods is in the phase relationships under which the LIVCs operate; the method found to be more efficient involves the phase separation of each of the four LIVCs by 45 degrees. Consideration is also given to the design, fabrication, and testing of a circuit for decreasing half-cycle unbalance in the current feedback transformers. Circuit operation is described, and circuit advantages and limitations are pointed out. L.E.W.

N67-28779*# Texas Instruments, Inc., Dallas. Semiconductor-Components Div.
DESIGN, DEVELOPMENT, AND DELIVERY OF 75-VA INTEGRATED STATIC INVERTER Final Report, Apr. 1965–Apr. 1967
Apr. 1967 145 p refs
(Contract NAS8-11925)
(NASA-CR-84800; Rept.-03-67-10) CSCL 10A

The 75-VA static inverter is a 28-V dc to 3ϕ sine-wave 400-Hz inverter designed for use as a gyro platform power supply. The basic circuit approach uses the technique of synthesizing a sine wave from a step-approximated waveshape. Among its performance characteristics are high efficiency (87 percent), good voltage regulation, and frequency stability; protection against damage by short circuits and overloads; and capability of operation over a wide ambient temperature range. Emphasis was placed on the use of integrated circuit arrays and integrated or multiple-chip power transistor packages wherever possible to increase reliability and reduce weight and volume. The report describes the circuitry, fabrication details, and overall inverter performance characteristics. Also considerable attention is devoted to operational characteristics and fabrication details of the three integrated-circuit arrays and the two types of dual-chip power transistors which were fabricated for the inverter. Author

N67-28786*# Allis-Chalmers Mfg. Co., Milwaukee, Wis.
FUEL CELL RELIABILITY ASSESSMENT Quarterly Progress Report, 8 Jan.–8 Apr. 1967
R. P. Bruno 8 May 1967 35 p
(Contract NAS8-2696)
(NASA-CR-84826; NAS8-2696-QPR-1204; QPR-4) CFSTI: HC $3.00/MF $0.65 CSCL 10A

The fuel cell construction and stack testing program are described. The results are discussed and graphed for the acceptance, performance evaluation, and reliability of the start-up, load cycle, low power life, thermal cycle, and high power life tests. Disassembly analysis included inspection of anode extrusion at the hydrogen inlet port, cathode extrusion at the oxygen inlet, and corrosion. Analytical studies are also reported on the effects of electrolyte concentration upon stack voltage degradation, reactant purging upon fuel cell performance, and matrix compression upon performance. N.E.N.

N67-28810 Joint Publications Research Service, Washington, D. C.
TRANSLATIONS ON COMMUNIST CHINA: SCIENCE AND TECHNOLOGY NO. 373 (FLUID TECHNOLOGY AND ITS APPLICATION)
Lu Shih 14 Apr. 1967 13 p Transl. into ENGLISH from Wu Hsien Tien Chishu (Peking), no. 5, 11 May, 1966 p 22–25
(JPRS-40634; TT-67-31278)

The advantages of fluidic devices over electronic devices are discussed, their working principles are described, and their applications to control systems, computer logic systems, and signal detection and reception equipment are mentioned. Examples of these applications are given and include a temperature sensor, a liquid surface controller, and a guided missile control system. R.N.A.

N67-28877*# Ion Physics Corp., Burlington, Mass.
SOLAR CELL COVER GLASS DEVELOPMENT Quarterly Technical Progress Report, 1 Sep.–30 Nov. 1966
30 Nov. 1966 28 p refs
(Contract NAS5-10236)
(NASA-CR-84839; QTPR-2) CFSTI: HC $3.00/MF $0.65 CSCL 10A

Integral coverslipped solar cells withstood rapid temperature cycling between $-196°$ and $+100°C$. Cells with up to 3 mil of high vacuum sputtered SiO_2 were tested. Cells with 4 mils of high vacuum sputtered SiO_2 have been produced. These cells have also been rapidly temperature cycled between $-196°$ and $+100°C$. Cells with 2 mil SiO_2 integral coverslips have been stored in a vacuum of $\approx 2 \times 10^{-7}$ torr for 500 hours at 100°C with no detectable loss in weight. Other cells, with 2 mil SiO_2 integral coverslips, have been irradiated with 0.4 MeV protons at fluxes of 10^{13}, 10^{14}, and 10^{15} protons-cm^{-2} with no measurable degradation. Author

N67-28914# Massachusetts Inst. of Tech., Cambridge. Center for Materials Science and Engineering.
INVESTIGATION OF A PIN-STRUCTURE GERMANIUM PHOTOVOLTAIC CELL Semiannual Report, 16 Jan.–15 Aug. 1966
B. D. Wedlock, R. Siegel, and C. R. Hewes 28 Feb. 1967 74 p refs
(Contract DA-28-043-AMC-01978(E))
(ECOM-01978-1; AD-650045) CFSTI: HC $3.00/MF $0.65

A solution to the V-I characteristics of planar P-I-N TPV converter diodes is developed and discussed in contrast to the usual PN devices. Improvements over the conversion efficiencies attained by PN devices seem easily attainable if present technology is adaptable to the new problems involved. A program to fabricate PIN devices was started and several important techniques developed. Both diffused and alloyed junctions were formed over large area samples (1 cm x 1 cm) and the techniques allowed reproducible results. Except for the final problem of forming low resistance contacts on the diffused N layer, the technological problems of the planar PIN diode have been solved. Author (TAB)

N67-28927*# Radio Corp. of America, Princeton, N. J.
ANALYSIS OF RADIATION DAMAGE IN SILICON SOLAR CELLS AND ANNEALING OR COMPENSATION OF DAMAGE BY IMPURITIES Final Report, 7 Jan. 1964–21 Apr. 1966
B. Goldstein, J. J. Wysocki, N. Almeleh, and P. Rappaport Washington, NASA, May 1966 22 p refs
(Contract NAS5-9131)
(NASA-CR-83860) CFSTI: HC $3.00/MF $0.65 CSCL 10A

Lithium doped silicon solar cells show an increased radiation resistance in two forms: a rapid recovery after cessation of the electron irradiation, and a slower degradation rate when the

irradiation flux rate is sufficient low. The lack of damage in the recovered cell is probably due to the preferential formation of a new damage center due to lithium migration, and the fact that these centers (L-centers) do not degrade the lifetime appreciably. Electron paramagnetic resonance studies were made of the interaction between lithium and electron irradiation defects in n- and p-type silicon, and in silicon in which lithium is the predominant impurity. In the latter case, lithium-defect interactions were observed. In n-type silicon, lithium decreases the A-center EPR absorption and, conversely, the A-centers decrease the lithium EPR absorption. In p-type silicon, lithium does not affect the EPR absorption due to the K-center. Paramagnetic properties and K-center growth were studied as functions of resistivity, impurity dopants, and illumination. A reverse-annealing occurred at about 250°C, followed by normal annealing of the damage to very low levels by about 450°C. A physical model of the K-center if offered in terms of a complex of two vacancies and two oxygen atoms which have trapped a hole. R.N.A.

04 BIOSCIENCES

Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

N67-27816 Medical Biological Lab. RVO–TNO, Rijswijk (Netherlands).

THE SIGNIFICANCE OF THE RADIATION DOSE RECEIVED FROM INHALED RADIO-ACTIVE MATTER BY AN AIRCREW ON A FLIGHT THROUGH A FALLOUT ENVIRONMENT [DE BETEKENIS VAN DE STRALINGSDOSIS TEN GEVOLGE VAN INHALATIE VAN RADIOACTIEF BESMETTE LUCHT VOOR VLIEGTUIG BEMANNINGEN]

A. J. Hoff Feb. 1967 15 p refs In DUTCH, ENGLISH summary
(MBL-1907-2; TDCK-47863) CFSTI: HC $3.00/MF $0.65

An aircrew on an operational mission through a fallout environment is exposed to ionizing radiation. The total dose can be divided into the direct dose originating from the gamma radiation of the radioactive particles and the indirect dose originating from inhaled radioactive matter. The ratio between the direct and the indirect dose is studied. Calculations show that the direct dose is larger than the indirect dose. The indirect dose is calculated for one special case on the basis of an estimation of the concentration of radioactivity in the cloud from a nuclear explosion and above a fallout region. Author

N67-27918# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.

LOW ENERGY β COUNTS AT THE RADIOACTIVITY MEASUREMENT LABORATORY OF GRENOBLE [LES COMPTAGES β DE FAIBLES ENERGIES EFFECTUES AU L.M.R.]

Anne-Marie Duplas, Michel Chevalier, and Henri de Choudens Nov. 1966 37 p In FRENCH
(CEA-R-3067) CFSTI: HC $3.00/MF $0.65

Radioelements emitting β low energy are very useful in biology especially in labelled compounds. The counting method with liquid scintillators is very often used. The Radioactivity Measurement Laboratory of Grenoble uses for these measures a tricarb Packard. The samples to be counted are: titrated water which is measured with a dioxane scintillator; animal textures which contain ^{14}C: these samples are dissolved in hyamine 10 X, then melted with a toluene scintillator; solid samples containing ^{14}C or ^{45}Ca (plant ashes): these samples are measured by suspension in scintillating mixtures. Gaseous samples of $^{14}CO_2$ are also counted, the gas is retained by hyamine, then mixed with a liquid scintillator. Counting of double labelled samples is also made on $^{45}Ca+^{32}P$ and $^{14}C+^{32}P$. The quenching corrections are made by internal standardization. Author (NSA)

N67-27968# Human Engineering Labs., Aberdeen Proving Ground, Md.

SOME STUDIES OF TEMPORARY HEARING LOSSES RESULTING FROM REPEATED EXPOSURE TO GUNFIRE NOISE

David C. Hodge and R. Bruce McCommons *In* Army Dept. Proc. of the 1966 Army Sci. Conf., Vol. I 26 Aug. 1966 p 469–483 refs (See N67-27941 15-34)
(AD-634690)

Reliability of individual and group mean temporary threshold shifts (TTS) of humans subjected to gunfire noise were studied to determine the effect of varying the number of impulses and the peak sound level of the impulses. Two studies were conducted with subjects having normal hearing, and a third study with subjects having subnormal hearing. Another study was made to determine reliability of the TTS with frequencies of 8000 cps and above. Individual TTS were not found to be sufficiently reliable to permit generalization of impulse noise effects, probably due to (1) daily differences in susceptibility to noise exposure and (2) variations in auditory thresholds. The group means vary less and are, therefore, considered a more reliable measure of noise effects on hearing. M.W.R.

N67-27991# Army Medical Research and Nutrition Lab., Denver, Colo. Physiology Div.

HEMODYNAMIC ALTERATIONS IN HUMANS AND ANIMALS DURING CHRONIC HIGH ALTITUDE EXPOSURE

James A. Vogel, James E. Hansen, and John P. Hannon *In* Army Dept. Proc. of the 1966 Army Sci. Conf., Vol. II 26 Aug. 1966 p 419–432 refs (See N67-27971 15-34)
(AD-634647)

Experiments were performed on human subjects and on dogs to determine if their cardiovascular and respiratory systems were able to maintain normal delivery of oxygen to body tissues at altitudes up to 14,000 ft. Heart rate, cardiac output, arterial blood pressure, stroke volume, and total peripheral resistance data were obtained of resting and exercising periods during two-week exposure to altitudes of 5,200 ft, 11,400 ft, and 14,000 ft. It was found that as arterial oxygen tension and saturation dropped with increase in altitude, arterial oxygen content dropped approximately 7% whereas venous content dropped only 5%, thus indicating reduced oxygen extraction from blood by the tissue. However, by a third week at 14,100 ft, tension and saturation had increased back to sea level values at rest. The increased total blood flow was an early body response to adapt to an environment of reduced oxygen tension; this cardiovascular response disappeared in direct relation to the increasing arterial oxygen content. G.G.

N67-28008*# Indiana Univ., Bloomington. Dept. of Anatomy and Physiology.

THE EFFECTS OF DEHYDRATION ON THE AEROBIC AND ANAEROBIC CAPACITIES OF MEN, PART IV Final Scientific Report

S. Robinson, B. Sadowski, and J. L. Newton 31 Dec. 1966 12 p refs
(Grant NsG-408)
(NASA-CR-84654) CFSTI: HC $3.00/MF $0.65 CSCL 06S

The effects of dehydration on V_{O_2} max, O_2 debt, blood lactate, and temperature regulation of 4 men in exhausting work and recovery were determined. In the dehydration experiments the men were dehydrated by 4.2 to 4.7% of body weight in the morning by working in the heat for 2 to 3 hours. They then rested for about 3 hours in a cool room without ingesting any fluid and

their responses during an exhausting treadmill run and recovery were determined. Control experiments were carried out without the dehydration. The average times of running to exhaustion were 4.63 and 4.04 min in the control and dehydration experiments respectively. Body temperature, V_{O_2} max, O_2 debt and the elevation of blood lactate in the runs were not significantly different in the two experiments. The reduced capacity for running in dehydration was associated with an average increase of 5% in the O_2 requirement per kg of body weight per minute of running time. The small increase in energy requirement was dependent on more rapid accumulation of the O_2 debt during the runs. Depletion of carbohydrate reserves was probably not a contributing factor to the decreased work capacity. Author

N67-28010*# California Univ., San Diego.
BRAIN MECHANISMS IN CONDITIONING AND LEARNING
Robert B. Livingston Brookline, Mass. Neurosci. Res. Program [1966] 116 p refs In Neurosci. Res. Prog. Bull. v. 4, no. 3, 30 Dec. 1966 p 235–347
(Grants NsG-462; Nonr(G)-00034-66; NIH GM-10211-05)
(NASA-CR-84656) CFSTI: HC $3.00/MF $0.65 CSCL 05J

Studies of higher mammals and the corresponding brain mechanisms thought to be involved in conditioning and learning are reported. The first topic considered under general concepts relating to conditioning and learning is growth of concepts pertaining to brain mechanism involved in higher nervous processes. Next reinforcement is examined from the standpoint of motivation, response-release, attention, and orientation. Some parameters involved in learning are cited and information processing of sensory signals is explained. Electric current delivered to the brain for discovering brain organization is discussed. The limbic-hypothalamic-brainstem systems are examined in relation to motivation and learning. Studies to determine whether or not measurable structural changes occur in the nervous system during prolonged periods of learning are described, and additional comments relating to human learning are presented. S.P.

N67-28013*# Miami Univ., Fla. Research and Teaching Center of Toxicology.
FLUORINE TOXICITY STUDIES Status Progress Report
M. L. Keplinger 1 Dec. 1966 14 p
(Grant NGR-10-007-012)
(NASA-CR-84659) CFSTI: HC $3.00/MF $0.65 CSCL 06T

Irritation in men from inhalations of fluorine were examined, and the results from single exposures are tabulated. Data indicated that irritation to the eye was the most sensitive index of a subjective effect. Another experiment was conducted to determine if damage to the kidneys would regress completely when animals were allowed to live longer than 45 days after exposure. Repeated intermittent exposures to fluorine appeared to cause less effects than a single exposure at the same concentration. Animals exposed to low concentrations of fluorine appeared to be less susceptible to effects caused by exposure to high concentrations of fluorine than animals not exposed previously. Formation of edema following exposure to fluorine was shown. Succinic dehydrogenase may be increased in the lung after inhalation of fluorine. Very young and old mice apparently are no more susceptible to fluorine than the young adult animal. S.P.

N67-28049# Institute for Defense Analyses, Arlington, Va.
ON THE THEORY OF COILING AND UNCOILING OF DNA MOLECULES
Elliott W. Montroll *In* Brookhaven Natl. Lab. Symp. on Inelastic Scattering of Neutrons by Condensed Systems Mar. 1966 p 57–68 refs (See N67-28041 15-24)

Various models of the process of simple thermal splitting and uncoiling of deoxyribonucleic acid (DNA) are briefly studied. A reasonable weight function for various sequences of the ladder bonding state is considered, in order to calculate the required statistical averages from the simplest random model. The most general one-component system model involving nearest-neighbor correlations only is defined. The first form of the partition function for a mixed system is expressed, as is the melting curve for the two-component zipper model. R.U.

N67-28091# Aerospace Medical Div. Arctic Aeromedical Lab., Fort Wainwright, Alaska.
HUMAN PERFORMANCE UNDER CONDITIONS OF COLD AND STRESS. REPORT ON UNIT EFFECTIVENESS
Richard G. Possenti Feb. 1967 17 p
(AAL-TR-66-11; AD-649513) CFSTI: HC $3.00/MF $0.65

At the request of the Surgeons Office, U.S. Army, Alaska, USARAL, the Arctic Aeromedical Laboratory psychologist accompanied 30 Army personnel on a field exercise near Eielson Air Force Base, Alaska, to study behavior and performance under conditions of cold and stress. The men were divided into squads of 10 men each, representing three companies. Personality and attitude scales were administered before, during and after the exercise. Analysis showed the essential character of dynamic leadership purpose and direction necessary for mission success. It also pointed up that the absence of these characteristics (variables) leads to independent and separate action with the consequent result of unit ineffectiveness. The most important factor in mission success seemed to be good leadership. TAB

N67-28095# Technology, Inc., San Antonio, Tex. Life Sciences Div.
CARDIOVASCULAR RESPONSES TO INCREASED G LOADING
David D. Michie and Clarence P. Cain Feb. 1967 98 p refs
(Contract AF 41(609)-2939)
(AD-648371) CFSTI: HC $3.00/MF $0.65

It is concluded that there is no single optimum back angle. Rather a back angle range of +10 degrees through -10 degrees appears to permit minimum distortion of cardiovascular function during a 90 second exposure to +G sub x forces ranging from 1 through 10 with the G sub z components varying from -0.75 through +2.7. In order to accurately evaluate the physiological effects produced by increased G loading, or the tolerance limits to these forces, it is imperative that the magnitude and direction of both the G sub x and G sub z vectors be known. Author (TAB)

N67-28199# School of Aerospace Medicine, Brooks AFB, Tex.
PHARMACOLOGY IN SPACE MEDICINE [PROBLEMA FARMAKOLOGII V KOSMICHESKOY MEDITSINE]
V. E. Belay et al [1966] 20 p refs Transl. into ENGLISH from Russian Presented at the 17th Intern. Astronautical Congr., Madrid, 9–15 Oct. 1966
(SAM-TT-R-808-0167; TT-67-61272; AD-648489) CFSTI: HC $3.00/MF $0.65

The study of the specific effect of medications under laboratory experimental conditions (G loads, weightlessness, prolonged isolation, etc.) and possible emergency situations (change in environmental gases, radiation effects, upset in meal schedule, etc.) is a necessary stage in the preparation for long space missions. Two basic aspects of the general problems of space pharmacology are: (1) enhance body tolerance to extreme flight factors and (2) natural response to medications during the simulation of some space-flight stresses. Author (TAB)

N67-28208# Pittsburgh Univ., Pa. Pymatuning Lab. of Ecology.
RADIOECOLOGY OF SMALL VERTEBRATE SPECIES UNDER NATURAL ENVIRONMENTS Progress Report, 1 Dec. 1965–30 Nov. 1966

[1966] 31 p
(Contract AT(30-1)-2579)
(NYO-2579-14) CFSTI: HC $3.00/MF $0.65

The ecology of three small mammals, the pocket gopher (*Thomomys talpoides*), the Unita ground squirrel (*Citellus armatus*), and the chipmunk (*Tamias striatus*) was investigated. The purpose of this work was to find a test animal suitable for radiation experiments. Gophers of northeast Wyoming were trapped at various altitudes and census records of populations were kept. Ground squirrels were found at the same altitudinal transect, but it was not possible to obtain accurate population figures because the animals began to enter hibernation in August. The chipmunk occurs from the Atlantic seaboard to Minnesota and census studies were made by a number of investigators. At Pymatuning Laboratory studies on analysis of population numbers and biomass of this mammal are being conducted. Results of all of these studies are presented in the form of tables and graphs. The measurement of thyroid secretory activity of small mammals was undertaken as an indication of total metabolic activity in order to study relative effects of radiation exposure. Animals were injected intraperitoneally with iodine-131-labeled sodium iodide and returned to their natural environment. After 48 hours the animals were recaptured, whole body counted, and returned again. The thyroid was counted separately in vivo. The slopes of whole body counts and thyroid counts were similar, indicating that whole body elimination of iodine-131 was a function of thyroid secretion of the isotope. Iodine-131 retention curves for free-ranging pocket gophers and ground squirrels were examined. It was noted that the weights of adrenal glands were significantly different at different elevations. The adrenal weights and iodine-131 curves tended to substantiate each other and offered correlative evidence as to the relative stress demands on the pocket gopher and ground squirrel at different elevations.
NSA

N67-28222*# Scientific Translation Service, La Canada, Calif.
VIABILITY OF MICROORGANISMS IN THE DESERT SOILS OF TURKMENIA [ZHIZNESPOSOBNOST'MIKROORGANIZMOV V PUSTYNNYKH POCHVAKH TURKMENII]
A. I. Zhukova and V. Kh. Kozlova Washington, NASA, Feb. 1967 8 p refs Transl. into ENGLISH from Mikrobiologiya (Moscow), v. 34, no. 3, 1966 p 503–508
(Contract NASw-1496)
(NASA-TT-F-10721) CFSTI: HC $3.00/MF $0.65 CSCL 06M

The viability of microorganisms under conditions of extreme dryness, irradiation and temperature, approximating those on Mars, was investigated in the Darvaza, Repetek and Dushak regions of Turkmenia, USSR in July, 1964. Air and soil temperature, CO_2 liberated by the soil, and total N_2 content were measured. It is found that water is more important for mass reproduction of microorganisms than organic matter.
Author

N67-28223*# International Information Inc., Philadelphia, Pa.
COACERVATES AND ENZYMES. PROTEIN–CARBOHYDRATE COACERVATES AND β-AMYLASE [KOATSERVATY I FERMENTY. BELKOVOUGLEVODNYYE KOATSERVATY I β-AMILAZA]
T. N. Yevreinova, T. A. Shubert, and M. N. Nestyuk Washington, NASA, Jan. 1967 8 p refs Transl. into ENGLISH from Dokl. Akad Nauk SSSR (Moscow), v. 105, no. 1, 1955 p 137–140
(Contract NASw-1499)
(NASA-TT-F-10685) CFSTI: HC $3.00/MF $0.65 CSCL 06A

The feasibility of the decomposition of starch in coacervate drops by enzymatic activity to low-molecular products, i.e., sugars is examined. In the solution of the problem, use was made of β-amylase, which decomposes starch primarily with the formation of maltose. The enzyme was obtained from soybeans. The preparation was active at pH 3.6–7.0. Therefore, for studying its activity, coacervates were selected which form at pH 4.4–4.8. In coacervate drops, containing gum arabic, gelatine, starch, and the enzyme β-amylase, the process of decomposition of starch to low-molecular compounds, i.e., sugar, has been shown.
Author

N67-28255# Aerospace Medical Div. Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio.
NEURAL INFORMATION PROCESSING IN THE PERIPHERAL AUDITORY SYSTEM OF THE GUINEA PIG
George R. Hanna Dec. 1966 27 p refs
(AMRL-TR-66-87; AD-649558) CFSTI: HC $3.00/MF $0.65

A number of first and second order neurons of the guinea pig auditory system were studied extensively in an attempt to determine the method by which information is conveyed. Single neuron electrophysiological techniques with anatomical controls were used in the study and in response to several different stimuli, various response patterns were observed. Statistical methods of analysis, using a digital computer, were employed. Each fiber in the auditory nerve appears to convey only fragmentary information; therefore, the information carried by a number of fibers is required to extract all the information about a single signal. The data suggest that a pulse density modulation system of encoding is used, in which the carrier appears to be the irregular spontaneous background activity, the pulse density of which is actively increased and decreased to convey information about both pitch and loudness. The system appears to be much more sensitive to sound changes than to absolute values. For example, pulse density correlated far better with rate-of-change of stimulus intensity than with absolute levels of intensity. In addition to frequency and amplitude, the interval between successive stimuli may be an important parameter of stimulation.
Author (TAB)

N67-28281*# National Aeronautics and Space Administration, Washington, D. C.
EXCRETION OF SULFURIC AND PHOSPHORIC ACIDS DURING PHYSICAL ACTIVITY [SCHWEFELSAURE- AND PHOSPHORSAURE-AUSSCHEIDUNG BEI KORPERLICHER ARBEIT]
George J. Engelmann Dec. 1966 13 p refs Transl. into ENGLISH from Arch. Anat. Phys., 1871 p 14–30
(NASA-TT-F-10487) CSCL 06A

The author describes and discusses a series of experiments on the sulfuric acid and phosphoric acid elimination with respect to the excretion of nitrogen. The experiments were conducted in man and took into consideration the objection that because of this complicated diet, man is useless for experiments on metabolism. The author concludes that physical activity increases the excretion of sulfuric and phosphoric acid; that urea is decreased with moderate activity; that excretion of sulfuric acid, rather than of urea, is an accurate indicator of albumin decomposition; and that excretions of sulfuric acid, phosphoric acid, and urea are not comparable.
Author

N67-28291*# International Information, Inc., Philadelphia, Pa.
HYDROGEN: THE CARRIER OF LIFE
M. Taube Washington, NASA, Feb. 1967 101 p refs Transl. into ENGLISH of the book "Wodorpierwiastek Zycionosny Przyczynek do Biologii Atomowej" Warsaw, Nucl. Energy Inform. Center, 1965 138 p
(Contract NASw-1499)
(NASA-TT-F-10712) CSCL 06A

The possibilities of a spontaneous abiogenic synthesis in nonliving surroundings, of molecules being the carriers of inner media, energy store, information store, and able to transport energy and information, have been considered. The hypothesis of a possible existence of life (in cosmic scale) apart from hydrogen compounds, especially beyond the liquid hydrogen oxide medium, have been critically rated. The eventual existence of life forms apart from hydrogen, oxygen, and carbon (i.e., of "non-carbon" life forms) has been eliminated from further considerations. There have been given sufficient reasons to support the thesis postulating

that the unique life carrier in cosmic scale is hydrogen and its compounds with oxygen, carbon, nitrogen, and phosphorus (and sulphur). Author

N67-28323# Aerospace Medical Div. Arctic Aeromedical Lab., Fort Wainwright, Alaska.
DIETARY MODIFICATIONS OF COLD-INDUCED METABOLIC EFFECTS
David A. Vaughan, Lucile N. Vaughan and Harold D. Stull Feb. 1967 15 p refs
(AAL-TR-66-12; AD-649326) CFSTI: HC $3.00/MF $0.65

Cold-exposed male Sprague-Dawley rats were forced to obtain their extra caloric requirements from either carbohydrate (sucrose) or fat (Crisco). Rats were killed, one, four and eight weeks after initiation of the feeding regimen. Carcass fat, protein, and moisture analyses were made. Liver glucose-6-phosphatase (G-6-Pase), hexose monophosphate (HMP) dehydrogenase, and glycogen were assayed. At the end of four weeks and eight weeks the percentages of fat in the carcasses of rats were significantly higher than in the cold-exposed rats receiving a mixed complete diet ad libitum. The two enzymes studied showed differing responses, HMP dehydrogenase increasing as a result of higher input of carbohydrate in the cold, and G-6-Pase increasing as an apparent result of cold exposure per se. Author (TAB)

N67-28505# Zurich Univ. (Switzerland).
ELECTRON MICROSCOPIC AND MORPHOMETRIC STUDY OF RAT LUNGS EXPOSED TO 97% OXYGEN AT 258 TORR (27,000 FEET) Research Report, Feb. 1964–Jul. 1965
Gonzague S. Kistler, Ewald R. Weibel, and Peter R. B. Caldwell (AMRL) Wright-Patterson AFB, Ohio, AMRL, Dec. 1966 21 p refs
(Contract AF 61(052)-784)
(AMRL-TR-66-103; AD-649542) CFSTI: HC $3.00/MF $0.65

A group of young growing rats was exposed to 97% oxygen at 258 torr in a controlled environmental chamber. They were sacrificed in groups after 1, 5, and 14 days and their lungs were processed for morphometric examination in light and electron microscope according to standardized procedures. No qualitative pathologic changes in lung structure were found even after 2 weeks of oxygen exposure. Only one exception was an apparent increase in the number of eosinophilic granulocytes within the lung capillaries of test rats which had been exposed to pure oxygen for 5 and 14 days. In the test animals a fall in lung volume and in lung-volume-to-body-weight ratio was concurrent with impairment of body growth. Morphometric analysis revealed a statistically high significant decrease in alveolar surface area, capillary surface area, and volume in dependence of the duration of oxygen exposure. These changes are interpreted as 'oxygen effect' which, however cannot be called 'oxygen toxicity' proper. Rather they are regarded as adaptation of the (growing) organism to increased oxygen tension in the breathing medium. Author (TAB)

N67-28517 Johann-Wolfgang-Goethe-Universitat, Frankfurt am Main (West Germany).
ON THE RADIATION SENSITIVITY OF BACTERIA [UEBER DIE STRAHLENEMPFINDLICHKEIT VON BAKTERIEN]
Maria Kraft (Ph.D. Thesis) 1962 106 p refs In GERMAN
Supported by the Max Planck-Inst. fuer Biophys., Frankfurt am Main

The initial purpose of the present work was to determine the minimum dose that affects microorganisms biologically. Experiments were conducted by irradiating E. coli B with X-rays. The dependence of radiation sensitivity on age of the culture, the nutrient medium, and air circulation was studied. The reaction to radiation was found to depend strongly on the physiological condition of the bacteria. It was also shown that apparently undamaged bacteria which remained capable of forming colonies were affected by the radiation directly and, in addition, by the presence of bacteria destroyed through radiation. Transl. by K.W.

N67-28546# Tracor, Inc., Austin, Tex.
STUDIES OF BINAURAL INTERACTION Summary Report
Walter T. Bourbon 1 Apr. 1967 82 p refs
(Contract Nonr-4193(00))
(TRACOR-67-372-U; AD-651145) CFSTI: HC $3.00/MF $0.65

The series of basic studies in binaural interaction continued with emphasis on two areas of investigation: manipulation of observers' criterion in auditory detection and critical bands of tonal stimuli. Work on a third area, detectability of tonal signals under conditions of azimuth certainty was also continued. TAB

N67-28898# RAND Corp., Santa Monica, Calif.
A THEORETICAL MODEL OF THE CORNEA FOR USE IN STUDIES OF TONOMETRY
C. C. Mow Apr. 1967 26 p refs Presented at the 4th Intern. Corneal Biophys. Workshop, Los Angeles, 9–10 May 1967
(P-3584; AD-651107) CFSTI: HC $3.00/MF $0.65

A theoretical model of the cornea, based on corneal dimensions and observed properties, is presented. It is shown that because of large differences in the thicknesses of the Bowman's and Descemet's membranes and the stroma; and because of the reported large differences in the elastic properties of the layers, a sandwich-shell model is a good approximation for the study of corneal deformation. The theory is applicable for applanation tonometry. A set of equilibrium equations based on Reissner's theory is given. Shell parameters which determine the behavior of shells are expressed in terms of the corneal properties and dimensions. Numerical examples which show the effects of corneal parameters on the stress resultants due to intraocular pressure are also given. Author (TAB)

N67-28706 Royal Aircraft Establishment, Farnborough (England).
PROTOPLASMIC STREAMING [PROTOPLASMASTROMUNG]
N. Kamiya Jan. 1967 21 p refs Transl. into ENGLISH from Protoplasma (Wien), v. 53, 1961 p 600–614
(RAE-LIB-TRANS-1208) CFSTI: HC $3.00

The problem of cytoplasmic streaming has been considered in two organisms, nitella and a myxomycete plasmodium. The force of cyclosis on streaming in intact nitella cells is measured by means of a centrifuge, a figure of 1 or 2 dynes per square centimetre is given. Streaming is shown to persist in segments of cells tied off and to be most vigorous at regions adjacent to the cortex. Chloroplasts in isolated drops of cytoplasm are shown to revolve rapidly. Cytoplasmic streaming force in plasmodium is measured by means of a special double chamber. The organism itself is the connecting link between the two parts of the double chamber, thus pressure changes in one part of the chamber are transmitted via the organism to the other part. By this means it is possible to counterbalance the motive force of streaming within the organism and to construct "dynoplasmograms". Inhibitors of respiration are not found to have any effect on motive force whereas inhibitors of glycolysis do have an effect. Author

N67-28720# Cornell Univ., Ithaca, N. Y. Cognitive Systems Research Program.
ON THE NEURAL MODELING OF SPEECH PROCESSES
Charles C. Tappert (Ph.D. Thesis) 15 Dec. 1966 178 refs
(Contract Nonr-401(40); Grant NSF-GK-250)
(Rept.-9; AD-649160) CFSTI: HC $3.00/MF $0.65

The work concerns the neural modeling of the human processes of speech production and perception. Part of this study deals with a new technique of speech synthesis. Newly defined generalized parameter waveforms, produced by an electronic waveform generator, are employed to approximate acoustic parameter transitions in the synthesis of dyad segments. The study also employs computer simulation studies to investigate neural models of: (1) the speech recognition process; (2) the control of speech production at the neural command level; and (3) feedback systems in the

speech acquisition processes of babbling and mimicking. One of the preprocessing systems for speech recognition employs a new technique of detecting time sequences of features. In modeling these processes emphasis was on adaptive networks. Author (TAB)

N67-28746*# National Aeronautics and Space Administration, Washington, D. C.

PHYSIOLOGICAL MEASUREMENTS IN SPACE-PRINCIPLES AND METHODS [FIZIOLOGICHESKIYE IZMERENIYA V KOSMOSE. PRINTSIPY I METODY]

V. V. Parin, B. B. Yegorov and R. M. Bayevskiy Feb. 1967 17 p refs Transl. into ENGLISH from the Russian Presented at 17th Intern. Astron. Cong., Madrid, 9–15 Oct. 1966

(NASA-TT-F-10678) CSCL 06B

The shift in physiological monitoring from the rudimentary safety requirements during early space flights to a systematic study of biological subjects by flight physicians and by means of sophisticated instrumentation is traced. Clinical-physiological tests modified for space flight application and newly developed procedures are discussed, including seismocardiography, variation pulsometry, and analysis of the motofacient act of handwriting. The use of these procedures aboard the Voskhod spacecraft and in connection with animal experiments aboard the Cosmos satellites is summarized. Sample results are included of an experiment with dogs that included application of various stimuli, administration of pharmacological substances, and study of the reaction to prolonged weightlessness. Requirements for future space flights are pointed out, and principles were formulated for the design of new systems for physiological measurements and data transmission. K.W.

N67-28866# Du Pont De Nemours (E. I.) and Co., Aiken, S. C. Savannah River Lab.

AN ALPHA-COUNTING HAND AND FOOT MONITOR

William J. Woodward Jan. 1967 20 p refs

(Contract AT(07-2)-1)

(DP-1080) CFSTI: HC $3.00/MF $0.65

An instrument was developed for detection of alpha contamination on hands and feet. A practical alpha foot monitor was made possible by improvements in the aluminum-coated film used to cover the scintillation detectors. In the instrument, scintillation detectors are connected to counters made from standardized plug-in circuits developed at the Savannah River Laboratory. Author (NSA)

N67-28892# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

SPACE BIOLOGY AND THE MAGNETIC FIELD [KOSMICHESKAYA BIOLOGIYA I MAGNITNOYE POLE]

Yu. A. Kholodov 31 Jan. 1967 8 p Transl. into ENGLISH from Priroda (Moscow), no. 4, 1966 p 114–115

(FTD-HT-66-717; AD-649340) CFSTI: HC $3.00/MF $0.65

The use of magnetic fields as a means of protecting spacecraft from ionizing radiations is mentioned in terms of the prolonged exposure of future astronauts/cosmonauts and other biological objects to either very weak or very strong fluxes. It is argued that magnetic fields have been shown to affect organisms up to the primate level strongly under certain conditions. Therefore, it is proposed that on the basis of this and other observations by Soviet researchers it may be expedient to create different magnetic fields for different spacecraft compartments, e.g., intense magnetic fields to stimulate Chlorella growth and terrestrial fields for cosmonauts. The author asserts that studies of the biological effects of magnetic fields cannot be overlooked; studies of the influence of magnetic fields on living processes which are being widely carried out by both Soviet and Western researchers not only will assure the safety of future spaceflights but will open up new areas in terrestrial biology. Author (TAB)

N67-28898# Naval Medical Research Inst., Bethesda, Md.

GAS CHROMATOGRAPHIC ESTIMATION OF CARBON MONOXIDE PRODUCED DURING OXYGEN ABSORPTION BY ALKALINE PYROGALLOL

Harold A. Collison and Frederick Lee Rodkey 28 Feb. 1967 11 p refs

(Rept.-14; AD-649327) CFSTI: HC $3.00/MF $0.65

Oxygen absorption by alkaline pyrogallol caused the formation of about 0.001 ml of carbon monoxide for each ml of oxygen absorbed. Larger amounts of CO were produced when the oxygen absorption capacity of the pyrogallol was nearly expended by absorption of more than 20 ml of oxygen per ml of pyrogallol. No carbon monoxide was produced when oxygen was absorbed with Fieser's solution. The use of Fieser's solution is recommended for oxygen absorption when minimal amounts of carbon monoxide are required in the residual gase. Author (TAB)

N67-28957# Pennsylvania State Univ., University Park. Ordnance Research Lab.

THEORIES OF BAT ECHOLOCATION

M. A. Mogus 15 Feb. 1967 68 p refs

(Contract NOw-65-0123-d)

(AD-650476) CFSTI: HC $3.00/MF $0.65

The aspects of bat performance most significant to the theories of echo location may be considered as range measurement, range resolution, target direction, resistance to jamming and the use of various types of ultrasonic pulses and repetition rates. The radar analogy theory first suggested by Hartridge and later expanded by Strother offers an heuristic explanation for most of the above. It explains range measurement, range resolution and resistance to jamming. The beat frequency theories attempt to explain the determination of range and direction, but not resolution, resistance to jamming or the changes in the pulse rates. Their major difficulty is that they may be applied only where overlap of pulse and echo is known to occur. The time difference tone theory explains only range measurements and considers the change in pulse rate and length as yielding more information on target range. Range resolution is not considered. The beat frequency and time difference tone theories possess two major difficulties. The first is that they depend upon the echo being audible to the bat. The second is that all experiments upon which these theories depend were conducted with human subjects. Author (TAB)

N67-28959# Texas Univ., Austin. Dept. of Psychology.

A COST-REWARD ANALYSIS OF REACTIONS TO EXTREME STRESS

Roland Radloff and Robert Helmreich Mar. 1967 103 p refs

(Contract N00014-67-A-0126-0001)

(TR-1; AD-650153) CFSTI: HC $3.00/MF $0.65

The report, based on analysis of the data from Project SEALAB II, represents an attempt to apply the costs, rewards and outcomes approach of Thibaut and Kelley (1959) to physically and psychologically stressful situations. The model proposes that persons will enter hazardous or other high cost environments voluntarily because of perceived benefits and that costs tend to be quite stable and rewards highly labile in environments characterized by negative physical stimuli. It is suggested that in developing social systems which are high in such costs, the rewards will decline more rapidly than costs (for example, the rewards in terms of prestige and public honors have declined more rapidly for successive Astronauts than have the costs in terms of physical hazard). This relatively rapid decline of rewards in comparison with costs can be expected to have negative effects on performance and adjustment in such situations and on volunteer and retention rates as well. The leadership role in relation to the cost-reward structure is analyzed and evidence in support of the model is cited. Author (TAB)

N67-28964# Service Bureau Corp., New York.
NEUROMIME NETWORK SIMULATOR Final Report, 19 Mar. 1963–15 Apr. 1966
James Flaugher Wright-Patterson AFB, Ohio, AMRL, Sep. 1966 137 p refs
(Contract AF 33(657)-11194)
(AMRL-TR-66-101, Vol. I; AD-650576) CFSTI: HC $3.00/MF $0.65

Because of the large number of network combinations and parameter variations possible in a Steele neuromime network, a program for simulating the nets on a digital computer is being developed to aid in determining the most efficient nets for specific tasks. The results of the investigation of network and parameter variations may then be used as the restraints and design criteria for neuromime devices with specific signal recognition capabilities. The simulation provides as a tool, a means of generating randomly connected networks with desired statistical restraints and a training phase which alters the network in such a manner as to force the actual response closer to the desired response. The generalized nature of the nets used is the essence of the research effort. Author (TAB)

N67-28974# Human Factors Research, Inc., Santa Barbara, Calif.
TRANSLATION AND APPLICATION OF PSYCHOLOGICAL RESEARCH
Robert R. Mackie and Paul R. Christensen Jan. 1967 151 p refs
(Contract Nonr-4337(00))
(TR-716-1; AD-650309) CFSTI: HC $3.00/MF $0.65

The processes involved in translating the findings of laboratory research in psychology into forms that would be meaningful and useful in operational settings are examined in detail. Particular attention is directed toward the psychology of learning and its apparently limited impact on educational and training technology. The viewpoints of academically and practically oriented psychologists toward various problems related to the translation and application of research are described and discussed: (1) the limited amount of effort being directed toward applications; (2) the detachment of many researchers from operational problems; (3) the narrowness of problem definition characteristic of theory-oriented research; (4) the problems involved in identifying theoretical and laboratory variables in the operational setting; (5) the effect of the choice of experimental stimulus and task conditions on the translatability of research; (6) the specificity of research results in relation to experimental, task and subject variables; (7) the need for short, synoptic summaries of research studies as an aid to collation, interpretation and translation; and (8) the need for the development of learning engineers as a link between the research and educational communities. A number of specific recommendations are made in the interest of increasing the relevance and applicability of psychological research sponsored by mission-oriented agencies in the Navy. Author (TAB)

05 BIOTECHNOLOGY

Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

N67-27931# Technische Univ., Berlin (West Germany). Institut fuer Flugfuehrung und Luftverkehr.
HUMAN ENGINEERING AS A SCIENTIFIC DISCIPLINE [DIE ANTHROPOTECHNIK ALS WISSENSCHAFTLICHE DISZIPLIN]
R. Bernotat [1966] 23 p In GERMAN; ENGLISH summary Presented at the Ann. Joint Meeting DGRR/WGLR, Bad Godesberg, W. Germany, Oct. 1966
(DGRR/WGLR Paper-66-086) CFSTI: HC $3.00/MF $0.65

After a short review of the development a definition of human engineering is given and the classification into other special subjects is shown. The main aspects of human engineering with the task separation of man and machine, the environmental layout, the dynamic adaptation of the machine to the human, and the argument of a scale for the mental work load are described. The simulator is indicated as the central tool of the scientist working in this field. The report closes with an abstract about the present state of human engineering in Germany. Author (ESRO)

N67-27982# Army Tank-Automotive Center, Warren, Mich.
THEORY OF HUMAN VIBRATION RESPONSE
Fred Pradko, Richard Lee, and Victor Kaluza *In* Army Dept. Proc. of the 1966 Army Sci. Conf., Vol. II 26 Aug. 1966 p 215–228 refs (See N67-27971 15-34)
(AD-634632)

Transfer function techniques were utilized to obtain the whole body human response to mechanical vibrations. Each combination of output and input was correlated with vibration force and output acceleration by equating human behavior to a linear system. The frequency spectrum was used to produce the transfer function from test data describing the input to man in terms of force, acceleration, frequency, and recorded output measurements taken at the subject's head. The upper boundary tolerance of human response was established by tests at various acceleration levels down to very low intensities. Correlation of analytical transfer function statements and experimental test data was established for random vibrations of 2 cps and 10 cps bandwidth filters. Indications showed that subjective response can be predicted by expanding the transfer function approach to include human response quantitatively and with time consideration; this new approach was called "absorbed power". G.G.

N67-28039# Royal Aircraft Establishment, Farnborough (England).
A NOTE ON THE MODEL MATCHING TECHNIQUE FOR THE MEASUREMENT OF HUMAN OPERATOR DESCRIBING FUNCTIONS
J. G. Jones Dec. 1965 24 p refs
(RAE-TR-65290) CFSTI: HC $3.00/MF $0.65

One method of measuring the describing function of a human operator in single axis closed loop control is to use an adaptive analogue model. This report discusses the application of this method with particular reference to the effects of human operator noise, or remnant, on the adapted state. Author

N67-28192# Applied Science Associates, Inc., Valencia, Pa.
A COMPARISON OF THREE METHODS FOR PRESENTING PROCEDURAL TROUBLESHOOTING INFORMATION Final Report, Apr. 1965–Mar. 1966
Thomas K. Elliott Wright-Patterson AFB, Ohio, AMRL, Dec. 1966 47 p refs
(Contract AF 33(615)-1137)
(AMRL-TR-66-191; AD-649598) CFSTI: HC $3.00/MF $0.65

The effects of subject aptitude and performance aid mode of presentation on the performance of procedural, between-stage troubleshooting tasks on a real piece of electronic equipment were studied. The study used nondecision aids presented in three modes, namely, an automatic retrieval of visual information, an automatic retrieval of audio information, and a manual retrieval of visual information. Two aptitude groups (Air Force electronic index 40-60 and 75-95) with no previous electronic training or experience were given from 3 to 5 hours of task training before the experiment. Each subject solved 26 actual, and 11 synthetic problems. The study indicated no difference in effectiveness of aids using visual

presentations. Both were superior to audio presentations. The two aptitude groups were equally effective in performing troubleshooting tasks using nondecision aids. In comparison with a previous study using decision aids, the study showed nondecision aids produced superior performance on the same between-stage troubleshooting problems using similar subjects. Author (TAB)

N67-28511# Bunker-Ramo Corp., Canoga Park, Calif.
THE METHODOLOGY OF CONTROL PANEL DESIGN Final Report, 1 Feb. 1964–30 Apr. 1965
D. Meister and D. E. Farr Wright-Patterson AFB, Ohio, AMRL Sep. 1966 78 p refs
(Contract AF 33(615)-1350)
(AMRL-TR-66-28; AD-646442)

Nine control panel drawings were developed by designers using standard design criteria from a designer's guide. The drawings were then evaluated by five experts representing the disciplines of human factors, industrial design, maintainability and reliability engineering. Sample panels were mocked up and subjects were tested in operational use of these panels. The major results of the overall study was that: (1) designers manifest a high degree of variability in developing control panel drawings even when presented with a standard package of design information; (2) human engineering design criteria appear to be significant only in relation to anticipated operator performance characteristics, and difficulties in applying these criteria stem from lack of empirical knowledge of these relationships; (3) a major source of difficulty in securing the application of human engineering design criteria by designers is the latters' lack of a system-behavioral approach to design. The major need in the control panel design area is empirical research to refine and standardize simple and quickly applied evaluation techniques. More information is needed concerning the manner in which designers utilize human factors and other design inputs. TAB

N67-28544# Illinois Univ., Urbana. Training Research Lab.
CONTEXTUAL PREDICTABILITY AND FREQUENCY FACTORS
Domenico Parisi, Ulderico Cappelli, and Lawrence M. Stolurow Aug. 1966 15 p refs
(Contract Nonr-1834(36); ARPA Order 454)
(TR-41; AD-651095) CFSTI: HC $3.00/MF $0.65

Cloze scores were obtained from 320 Ss for two written Italian passages totaling 616 words in such a way that each word was guessed by 32 Ss. Each word was classified into one of 12 grammatical classes. As has been found for English, content words are less predictable than function words if guessing the specific missing item is required. No such difference exists when only correct form class has to be predicted. Type-token ratio for each class appears to be correlated with specific item predictability, whereas proportion of occurrences of each form class in the language is correlated with form class predictability. Both correlations suggest that frequency properties may be an important factor even in complex language behavior. Author (TAB)

N67-28604# Bunker-Ramo Corp., Canoga Park, Calif. System Effectiveness Lab.
A FURTHER STUDY OF THE USE OF HUMAN FACTORS INFORMATION BY DESIGNERS Final Report, 16 Sep. 1966–15 Mar. 1967
David Meister and Dennis J. Sullivan 16 Mar. 1967 100 p refs
(Contract Nonr-4974-00)
(AD-651076) CFSTI: HC $3.00/MF $0.65

The study was performed to verify an earlier investigation which concluded that designers had little or no interest in human factors information and usually failed to apply human factors criteria to design. Ten designers from the Douglas Aircraft Company were presented with 3 4-hour tests in which they were required to develop equipment drawings, solve design problems analytically, rate the importance of design parameters, use MIL-STD-803 and similar documents, and review human factors handbook material. The general conclusions resulting from the earlier study was verified. Design analysis involved primarily the equipments mechanical/electrical functioning. Subjects showed little interest in or ability to apply human factors data to their design problems. Internal components and equipment structure determined the selection and arrangement of controls and displays. Human factors was not recognized as a distinct discipline, nor were human factors problems in design recognized as such. There was almost no use of human factors specialists to resolve such problems. As was found in the earlier study, human factors information in handbook form is not acceptable to designers because of its academic mode of presentation and because much of the material is non-applicable to design problems. Much of the material in human factors standards is not considered to be mandatory in controlling design. Author (TAB)

N67-28635# Naval Submarine Medical Center, Groton, Conn.
AN EVALUATION FOR USE IN AUDIOMETRY OF THE NOISE ATTENUATION OF THREE TYPES OF CIRCUMAURAL EARMUFFS
Cecil K. Myers 23 Jan. 1967 14 p refs *Its* Memo Rept.-67-1
(AD-650097) CFSTI: HC $3.00/MF $0.65

In a study designed to find the best circumaural muff for routine testing of hearing, especially in group testing situations, three good quality circumaural muffs, commercially available, were compared. The Otocup was found superior in noise-attenuation properties. Data is presented which should be useful as a base for equipment specifications for audiometric clinics. Author (TAB)

N67-28754*# Sperry Phoenix Co., Ariz.
AVIONICS REQUIREMENTS FOR ALL WEATHER LANDING OF ADVANCED SST's. VOLUME II: STATE-OF-THE-ART REVIEW OF ALL WEATHER LANDING SYSTEM TECHNIQUES Final Report
S. S. Osder Apr. 1967 108 p refs
(Contract NAS2-4124)
(NASA-CR-73093) CFSTI: HC $3.00/MF $0.65 CSCL 05H

Display concepts and techniques for flight control and approach are reviewed in connection with human factors. The technology of electromagnetic reference systems and devices for all-weather landing (AWL) applications are assessed, including instrument landing systems, cooperative ground radar/data link systems, advanced integrated landing systems, artificial imaging, and navigational aids. A summary is presented of the control configurations used in present-day jet transport automatic landing systems. A discussion of redundancy and monitoring techniques covers pertinent terminology, summed composite signal transmission, mid-value logic systems, triplex switched single output systems, high gain/low saturation systems, triplex AWL system reliability, and the complexity of redundancy. K.W.

N67-28829*# Aerospace Medical Div. Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio.
EVALUATION OF FUEL CELL WATER FOR HUMAN CONSUMPTION
Bernard J. Katchmann, Carol Linder (Miami Valley Hospital), Sheldon A. London, Arselus West, and George Kitzes et al Nov. 1966 15 p refs
(Contract AF 33(657)-11716)
(NASA-CR-84845; AMRL-TR-66-141) CFSTI: HC $3.00/MF $0.65 CSCL 06K

Water obtained from a hydrogen-oxygen fuel cell was subjected to chemical, organoleptic, and microbiological analyses and found to be acceptable according to the U.S. Public Health Service Standards. To ascertain the acceptability of this water, eight male

subjects were confined to a self-care unit at Miami Valley Hospital, Dayton, Ohio, for a 2-week period and served a controlled 4-meal-per-day diet, low in water content. A minimum of 2 liters per day of either distilled water or fuel cell water was drunk by the subjects as follows: two subjects were served distilled water for 2 weeks, serving as controls; four were served fuel cell water for 2 weeks; and two were served fuel cell water for one week, followed by distilled water for the second week. Twenty-four hour surveillance of the subjects was maintained. They were examined by a physician at least once daily; daily urinary and periodic blood samples were taken for routine laboratory examination. The subjects showed no clinical symptoms at the end of the test period, and the fuel cell water was found to be as acceptable as distilled water in constituting part of a daily diet for the 2-week period.
Author

N67-28885# Lockheed-Georgia Co., Marietta.
PERFORMANCE AND PHYSIOLOGICAL EFFECTS OF LONG TERM VIBRATION Final Report, 7 Jul. 1966–1 Jun. 1966
C. L. Holland, Jr. Wright-Patterson AFB, Ohio, Aerospace Med. Res. Labs, Oct. 1966 61 p refs
(Contract AF 33(615)-2921)
(ER-7979-12; AMRL-TR-66-145; AD-649366) CFSTI: HC $3.00/MF $0.65

The present study was designed to investigate human performance as a function of selected parameters of simulated, random, vertical vibration environments. Twelve volunteers were subjected to four different vertical vibration environments for 6 hours at a session. The vibration environments varied with respect to acceleration level (0.12G rms and 0.16G rms) and with respect to the frequency distribution of acceleration power. Both acceleration power density spectra employed had significant frequency components in the frequency range of 1 to 6 cycles per second, but differed in the location of peak acceleration power. During vibration and control sessions, subjects were required to perform a task complex that included two-dimensional, compensatory tracking and secondary visual and auditory loading tasks. Performance measures were taken for 45 minutes of each hour. Heart rate, respiration rate, and skin temperature measures were also recorded. Tracking error scores on both axes were significantly larger under all vibration conditions than those scores obtained during static test sessions. The two acceleration levels investigated did not differentially affect tracking error. The results of a supplemental investigation indicated that tracking performance was degraded more by a spectrum that had peak power at 5 cps than one with a similar frequency content but with a peak power at 2 cps.
Author (TAB)

N67-28886# Federal Fire Council, Washington, D. C.
HAZARDS OF CARBON TETRACHLORIDE FIRE EXTINGUISHERS: RECOMMENDED PRACTICES NUMBER 3
Jan. 1967 39 p refs
(AD-649465) CFSTI: HC $3.00/MF $0.65

The report attempted to present just a few of the highlights of the history of the chemical liquid known as carbon tetrachloride. Some of its early uses in medicine and its later applications in industry and as a fire extinguishant were discussed. The toxicity of carbon tetrachloride, particularly with reference to its use as a fire extinguishant, was examined in some detail. And finally, its efficiency in extinguishing fires in hydrocarbon fuels was analyzed.
Author (TAB)

N67-28904# Melpar, Inc., Falls Church, Va.
UTILIZATION OF INFRARED SPECTROPHOTOMETRY IN MICROCONTAMINANT STUDIES IN SEALED ENVIRONMENTS Final Report, 2 Jun.–29 Jun. 1965
Hannibal de Schmertzing and Julian H. Chaudet Brooks AFB, Texas, School of Aerospace Medicine, Jan. 1967 27 p ref
(Contract AF 41(609)-1962)
(SAM-TR-67-2; AD-650000) CFSTI: HC $3.00/MF $0.65

The purpose of this work was to determine microcontaminants in a sealed environmental system. The separation and identification of the collected samples were accomplished with gas-liquid chromatography and infrared spectrophotometry. Fifth-four sets of samples of the atmosphere from a Brooks Air Force Base space cabin simulator, comprising 162 individual samples, were analyzed. The method used was gas-liquid chromatography using a flame ionization detector. The retention time on the column was used for identification, while the peak area was used for quantitative estimation of the compounds. A collection of the vapor infrared spectra of 146 compounds, which are possible contaminants for space cabin simulators, has been compiled during the 2 years of this contract. A computer program for sorting infrared spectra with the aid of the ASTM deck of infrared cards has been established. Analyses have been made of gases evolved from paint panels, from the decomposition of a Teflon insulator, and from human waste products.
Author (TAB)

06 CHEMISTRY

Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

N67-27781# United Kingdom Atomic Energy Authority, Wantage (England). Isotope Research Div.
SEARCH FOR PROPANOL FORMATION IN GAMMA-IRRADIATED CARBON DIOXIDE–PROPANE MIXTURES AS A MEASURE OF TRIPLET AND SINGLET OXYGEN ATOM REACTIONS WITH HYDROCARBONS
R. W. Hummel Jan. 1967 7 p refs
(AERE-R-5336) HMSO: 1s 9d

The formation of n-propanol and isopropanol has been used as a measure of oxygen atom reactions. Photolyses of N_2O/C_3H_8 mixtures gave a n-propanol/isopropanol ratio approximating that expected from $O(^1D)$ reactions. Radiolyses of N_2O/C_3H_8 and CO_2/C_3H_8 mixtures indicated an insignificant contribution by $O(^1D)$.
Author

N67-27797# Royal Aircraft Establishment, Farnborough (England).
STUDIES ON KINETICS AND THE MECHANISM OF THE OXIDATION OF HYDROCARBONS IN THE GAS PHASE. PART IV. A GAS CHROMATOGRAPHIC METHOD FOR THE ANALYSIS OF THE INTERMEDIATE OXIDATION PRODUCTS OF n-HEPTANE [STUDIUM DER KINETIK UND MECHANISMUS DER OXYDATION VON BENZINKOHLENWASSERSTOFFEN IN DER GASPHASE. IV. MITTEILUNG. EINE GASCHROMATOGRAPHISCHE METHODE ZUR ANALYSE DER OXYDATIONSZWISCHENPRODUKTE DES n-HEPTANS]
E. Schroder, G. Ohlmann, and E. Leibnitz Dec. 1966 12 p refs Transl. into ENGLISH from Z. Physik. Chem. (Frankfurt), no. 225, 1964 p 168–174
(RAE-LIB-TRANS-1203) CFSTI: HC $3.00/MF $0.65

A multiple column suitable for the analysis of the intermediate oxidation products of n-heptane, consisting of several sections with various stationary phases connected in series, is developed by the determination of the most efficient combination of columns calculated from measured data on the separation of test mixtures by 2-m columns with simple column packings.
Author

N67-27814 United Kingdom Atomic Energy Authority, Harwell (England). Analytical Sciences Div.
THE DETERMINATION OF NITROGEN IN URANIUM NITRIDES BY INERT GAS FUSION

B. L. Taylor and B. S. Perrett Jan. 1967 11 p refs
(AERE-R-5247) HMSO: 1s 9d

An inert gas fusion method for the determination of nitrogen in uranium nitrides is described. The sample is heated to ≈1900°C in a graphite resistance furnace and the nitrogen evolved is removed in a stream of helium. The nitrogen is separated from the helium by absorbing it on molecular sieve cooled with liquid nitrogen. On completion of the reaction the molecular sieve is heated and the nitrogen pumped into a gas burette by a mercury diffusion pump. Uranium and aluminium nitrides have been successfully analysed by this method. Author

N67-27875# European Atomic Energy Community, Ispra (Italy).
THE RADIOLYTIC AND PYROLYTIC DECOMPOSITON OF ORGANIC COOLANTS. III: THE RADIOLYSIS AND PYROLYSIS OF m-TERPHENYL AND m-TERPHENYL-d_{14}
G. Juppe, H. Rau, and F. Dorpema Mar. 1967 37 p refs
(EUR-3172.e) CFSTI: HC $3.00/MF $0.65

The investigation of both the radiolysis and the pyrolysis of unlabelled m-terphenyl and m-terphenyl-d_{14} are reported. A comparison of the kinetics of pyrolysis showed that the deuterated compound suffered lower destruction of the starting material than did the m-terphenyl. Furthermore less hydrogen and aliphatic hydrocarbons, benzene, diphenyl, quaterphenyls, triphenylbenzenes and triphenyl, and high boilers were formed with the deuterated compound. The reaction orders for the decomposition of the starting terphenyls as well as for the formation of the reaction products were determined. The quantitative differences in the reaction rates and the composition of the pyrolysis products are attributed to a small difference in the bond dissociation energy between the aromatic CH- and CD-bonds. The radiolysis of unlabelled m-terphenyl and m-terphenyl-d_{14} by 2 MeV electrons also showed a greater stability of the deuterated terphenyl. A lower rate of m-terphenyl-d_{14} destruction was observed. The reaction mechanism of the radiolytic decomposition of aromatic hydrocarbons is discussed. Author

N67-27896 United Kingdom Atomic Energy Authority, Harwell (England). Chemical Engineering and Process Technology Div.
A FORTRAN PROGRAMME FOR THE PROCESSING OF PERMEABILITY DATA IN POROUS DATA
R. A. Huber and J. Roberts Nov. 1966 15 p refs
(AERE-M-1825) HMSO: 2s 6d

A computer program PERCOLATED which has been developed for the processing of permeability data for various gases in porous media at temperatures between 0°C and 700°C, is described. It contains two novel criteria for the exclusion of non-correlating data. Viscosity and molecular weight data for most of the common gases used in permeability determinations are incorporated in the program, which may readily be modified to include other gases. The program is written in the FORTRAN (S2) language for the IBM 7030 (STRETCH) computer. Author

N67-27911# Kansas Univ., Lawrence. Dept. of Chemistry.
TITANIUM-VANADIUM-OXYGEN SYSTEM. PART I: PHASE STUDY. PART II: STRUCTURE STUDY. PART III: VAPORIZATION STUDY
Sin-Shong Lin (Ph.D. Thesis) 8 Nov. 1966 381 p refs
(Contract AT(11-1)-1140)
(COO-1140-152) CFSTI: HC $3.00/MF $0.65

The phase behavior, crystal structure, and vaporization behavior of the Ti–V–O system was investigated. The phase behavior of the system was studied by X-ray diffraction techniques. The ternary samples were prepared by arc-melting appropriate mixtures of the binary oxides followed by annealing. More than fifty tenary samples were prepared between the compositions M_2O and MO_2. The samples prepared in the MO region were found to disproportionate into sesquioxides and suboxides. A complete solid solution region from Ti_2O_3 to V_2O_3 and a new phase having the composition Ti_2VO_5 were established. A wide homogeneity range of VO_2 in TiO_2 was found. Some phase relations have been established in this system, and finally, the partial phase diagram was constructed from the available information. The vaporization behavior was studied by means of successive vaporization, Knudsen effusion, and mass spectrometric investigations of the ternary samples. The successive vaporization was carried out on seven samples in open crucibles. NSA

N67-27916# Michigan State Univ., East Lansing. Dept. of Chemistry.
CERIUM–OXYGEN–NITROGEN SYSTEM
Kenneth J. Manske and Harry A. Eick 15 Dec. 1966 12 p refs Presented at 153rd Natl. Meeting, Am. Chem. Soc., Miami Beach, Fla.
(Contract AT(11-1)-716)
(COO-716-026; CONF-670401-5) CFSTI: HC $3.00/MF $0.65

Phase studies on the Ce–O–N system showed that it exhibits fcc symmetry. However, the Ce–O–N phase cannot be regarded as a solid solution of either CeO_2 or Ce_2O_3 in cerium nitride, since CeO_2 has the fluorite type cubic structure and Ce_2O_3 has the trigonal "A" type lanthanon sesquioxide structure. Cerium nitride may be considered an interstitial compound in which the nitrogen atoms are located in holes between the cerium atoms situated on a fcc lattice. The oxygen ion with a radium of 1.40 Å could substitute easily for the nitride ion of radium 1.53 Å. Vaporization data for cerium nitride are tabulated. Methods for preparing the system are discussed in detail. NSA

N67-27970# Army Nuclear Defense Lab., Edgewood Arsenal, Md.
OBSERVATION OF SHORT-LIVED SPECIES PRODUCED BY X-RAY PULSES
Nathan Klein *In* Army Dept. Proc. of the 1966 Army Sci. Conf., Vol. I 26 Aug. 1966 p 515–526 refs (See N67-27941 15-34)
(AD-634693)

Reactions of the hydrated electron were studied during and immediately after a radiation pulse. The trace for a typical X-ray pulse obtained with a plastic scintillator vacuum diode and a 2 GHz oscilloscope, is shown. Pulse shape and amplitude are found to be highly uniform; and dose per pulse as measured by thermoluminescent dosimeters is approximately 4 krad. A model of the irradiated solution was devised; and it was found that the reaction of the water with radiation produces both unstable species and the hydrated electron and several other products that will react with these species. This homogeneous kinetics model for the radiolysis of aqueous solutions, although adequate at lower dose rates, does not explain many of the experimental results. It is postulated that model breakdown may be due to (1) the fact that the *a priori* assumption of homogeneous kinetics is unvalid or (2) the reaction scheme is not applicable for all the reactions that actually occur. M.W.R.

N67-27976# Coating and Chemical Lab., Aberdeen Proving Ground, Md.
COHESIVE ENERGIES IN ORGANIC LIQUIDS
Edwin F. Meyer, Robert E. Wagner, and Myer Rosenfeld *In* Army Dept. Proc. of the 1966 Army Sci. Conf., Vol. II 26 Aug. 1966 p 113–126 refs (See N67-27971 15-34)
(AD-634625)

Described is a method for quantitative estimation of cohesive energy in organic liquids that uses vaporization energy approximation to separate the molecules to infinity. By increasing the length of the hydrocarbon chain, more atoms per molecule attract each other and increase the cohesive energy. The CH_2 increment is constant under conditions of constant time average distances between interacting centers when all molecules are absolute zero.

or when each CH_2 group has a fixed molar volume at adjusted temperature. Calculations on methyl n-alkyl ketones show that dispersion always predominates, orientation loses importance as the hydrocarbon chain increases, and induction energy contributes 5 to 10% to the total cohesion of the higher 2-ketones. G.G.

N67-27979# Picatinny Arsenal, Dover, N. J. Explosives Lab.
MECHANISM FOR CONTROLLING THE REACTIVITY OF LEAD AZIDE
Vencatesh R. Pai-Verneker and Arthur C. Forsyth *In* Army Dept. Proc. of the 1966 Army Sci. Conf., Vol. II 26 Aug. 1966 p 169–181 refs (See N67-27971 15-34)
(AD-634629)

The effects of particle size, impurity content, and preparation methods on the thermal decomposition rate of lead azide was studied in iron doped samples. Thermal sensitivity was measured by the time for a sample to explode at a fixed temperature. Results showed that α–PbN_6 sensitivity increased as the surface area increased; Fe^{3+} incorporation up to 1×10^{-2} mole% desensitized α–PbN_6, whereas $[FeN_3]^{2+}$ content very markedly sensitized the sample and changed its optical absorption. α–PbN_6 prepared from lead nitrite and hydrazoic acid was found least sensitive. G.G.

N67-27988# Frankford Arsenal, Philadelphia, Pa. Pitman-Dunn Research Labs.
FERROCENE CHEMISTRY OF PHOSPHORUS AND BORON
Gilbert P. Sollott, William R. Peterson, Jr., and Jonathan L. Snead *In* Army Dept. Proc. of the 1966 Army Sci. Conf., Vol. II 26 Aug. 1966 p 339–354 refs (See N67-27971 15-34)
(AD-634641)

Ferrocene derivatives and polymers were studied for their potentials as heat resistant lubricants, plastics, adhesives, their formation of new molecular complexes with phosphite esters, and the cleavage mechanism of their ester P–O bonds. Also investigated was the production of triferrocenylborane and its ability to form adducts with phosphines incuding triferrocenylphosphine. The previously unknown diferrocenylborinic acid and triferrocenylborane were prepared via reactions of boron fluoride etherate and boron tribromide with lithioferrocene. G.G.

N67-27995# Army Natick Labs., Mass.
LIGHT ATTENUATION BY PHOTOCHEMICAL MEANS: PHOTOCHROMISM
Julius Weinstein, Aaron L. Bluhm, Margaret E. Langmuir, and E. Thomas Strom *In* Army Dept. Proc. of the 1966 Army Sci. Conf., Vol. II 26 Aug. 1966 p 481–494 refs (See N67-27971 15-34)
(AD-634651)

The mechanism of color change in photochromic crystals was studied by establishing the essential structural features required for photochromism upon exposure to visible and/or ultraviolet light. Flash photolytic techniques and color rate measurements on sample solutions in ethanol and cyclohexane were performed with various photochromatic aromatic nitro compounds having a nitro and a C–H group ortho to each other. It was shown that the dark fading reaction of all o-nitrobenzyl compounds studied followed first-order kinetics and that substituents in the para position of the aromatic ring of o-nitrobenzylpyridines affected the rate of the fading reaction. Ultraviolet irradiation of 3,3'-dinitro-4, 4'-di(2-x pyridylmethyl) azoxybenzenbe resulted in simultaneous aci-nitro–nitro tautomerization and geometrical isomerization. Structural requirements for photochromism in 1-aryl-2-nitroalkenes was a cis relationship of their nitro and phenyl groups. G.G.

N67-28004*# Ledoux and Co., Inc., Teaneck, N. J.
APPLICABILITY OF THE LOW-TEMPERATURE IGNITION METHOD FOR DETERMINING CARBON IN VARIOUS ALKALI METALS
E. W. Hobart, R. Stevenson, and S. Kallmann 21 Oct. 1966 14 p refs
(Contract NASw-1192)
(NASA-CR-84377) CFSTI: HC $3.00/MF $0.65 CSCL 07B

Kallmann and Liu's low temperature ignition method for carbon in sodium has been extended to the other alkali metals. Good recoveries of carbon, added as sucrose, potassium acid phthalate, carbon black and alkali carbonate, have been achieved for the metals: NaK alloy, potassium, rubidium and cesium. Lithium, however, is not amenable to the method. Gas chromatographic measurement of carbon dioxide has extended the sensitivity of the method to the one ppm carbon range. Author

N67-28011*# Carnegie Inst. of Tech., Pittsburgh, Pa. Dept. of Chemistry.
ELECTROCHEMICAL STUDIES IN NON-AQUEOUS SOLVENTS. I: ACETONITRILE
L. M. Gedansky and K. S. Pribadi [1966] 28 p refs
(NASA Order R-09-022-029)
(NASA-CR-84657) CFSTI: HC $3.00/MF $0.65 CSCL 07D

Certain electrochemical data (and closely related auxiliary data) are critically reviewed for various nonaqueous solvents. The principal emphasis has been on electrochemical potentials as derived from more or less traditional cell measurements or polarographic measurements. For some solvents, these data may be usefully extended by calculations of potentials from thermodynamic data. Since auxiliary data such as acid ionization constants, activity coefficients, solubility products, and transport numbers are often relevant to experimental determinations of potentials or to subsequent use of potentials, such data have been summarized. Discussions are concerned with acetonitrile, which is the most common of the nitrile solvents. It is both a weaker base and a weaker acid than water and appropriate acidity studies have shown it to be a good differentiating solvent. Some physical properties of acetonitrile are summarized. Author

N67-28015*# Villanova Univ., Pa. Research and Development Div.
KINETIC STUDY OF ELECTRICALLY ACTIVATED REACTING SYSTEMS AT RELATIVELY LOW TEMPERATURE LEVELS Annual Status Report, Sep. 1965–Sep. 1966
George C. Yeh and Henry T. Koonce Sep. 1966 17 p refs
(Grant NGR-39-023-002)
(NASA-CR-84661) CFSTI: HC $3.00/MF $0.65 CSCL 07B

In a study of electrically activated reacting systems it was proposed that the local surface field resulted from the roughness of the surface of conductor be used in determining the density of field emission current by the Fowler–Nordheim equation, instead of the externally applied field. Accordingly, metal surfaces having definite roughness are being considered for the theoretical models as well as experimental electrodes. Once the surface field has been precisely defined the identification and characterization of the species under the influence of field emission may be properly analyzed and their interactions closely studied. Due to the unexpected difficulty met in obtaining the high temperature reactor, a readily available Pyrex-glass reactor was used for the preliminary investigation of the reaction between H_2 and I_2 and that between N_2 and H_2 at temperatures below 200°C and 1 atm. Many difficulties encountered are discussed with the experimental results obtained and recommendations for future work. These recommendations include the modification of reactor and electrodes, the better sampling technique, and the quenching of the gas product. Author

N67-28086# Lexington Labs., Inc., Cambridge, Mass.
VAPOR PHASE GROWTH OF RUBY MONOCRYSTALS Semiannual Technical Summary Report, 15 Jul. 1966–15 Jan. 1967
Philip S. Schaffer 15 Feb. 1967 22 p refs
(Contract Nonr-4574(00)-2; ARPA Order 306; Proj. Defender)
(AD-648386) CFSTI: HC$3.00/MF$0.65

Ruby monocrystals were produced by vapor phase growth using chromium organometallic compounds as the chromium dopant ion source. The low decomposition temperature of these compounds prevented high dopant homogeneity and sufficiently long growth runs to be successfully conducted. Growth furnace modifications were made which should enable three inch long by 3/8 - 1/2 inch diameter crystals to be grown having their longitudinal axes perpendicular to the impinging reactant gas stream. Other modifications were incorporated into the growth system which should enable continuous runs up to 100 hours duration, elimination of some of the problems of non-uniform dopant homogeneity and secondary nucleation, and further improve crystalline purity. Author (TAB)

N67-28176 Joint Publications Research Service, Washington, D. C.
PRECIPITATION OF OXIDES FROM A SODIUM FLOW
V. I. Subbotin and F. A. Kozlov *In its* Sodium-Cooled Nucl. Reactors 24 Feb. 1967 p 31–53 refs (See N67-28173 15-22)
(SM-85/48)

The results obtained show that the precipitation of oxides from the sodium flow is a complex physicochemical process, dependent on temperature and hydrodynamic conditions, on the distribution of mass transfer surfaces, and on the amount of oxides already settling on the mass transfer surface. In the cooling zone with constant temperature gradient and uniform distribution of mass transfer surfaces, the precipitation of oxides occurs nonuniformly by zone length. Local buildup of oxides occurs, leading to the plugging of the passage cross-section. For cold traps this means uneven use of their volume, and hence, a drop in capacity for oxides. The oxide concentration in the mixture sodium oxide–sodium forming in the trap section depends on the conditions of its formation. Temperature gradients and hydrodynamic forces in conjunction with time factors promote an increase in oxide concentration. These factors indicate the difficulties of designing cold trap cooling zones. Author

N67-28209# General Dynamics Corp., San Diego, Calif. General Atomics Div.
DIFFUSION OF METALLIC FISSION PRODUCTS IN PYROLYTIC CARBON
P. E. Gethard and L. R. Zumwalt 15 Dec. 1966 23 p refs
(Contract AT(04-3)-633)
(GA-7478) CFSTI: HC$3.00/MF$0.65

The diffusion of Sr and Cs through thin layers (100μ) of isotropic pyrolytic C was measured over the temperature range from 1000° to 1700°C. Diffusion coefficients observed for Cs were orders of magnitude lower than those for Sr. The diffusion rates for both series were much lower than those observed in polycrystalline graphite, where little difference was seen between Cs and Sr. When constant chemical potential sources were used, chemical- and self-diffusion measurements for Sr gave identical results in the concentration range 1.0×10^{-4} to 2.0×10^{-3} g Sr/g graphite. There was apparently no concentration effect for Cs over the range 1.0×10^{-7} to 1.5×10^{-3} g Cs/g graphite. The difference between Sr and Cs diffusion in pyrolytic C is attributed to the greater steric effect of the pyrolytic C defect structure relative to that of Cs. Author (NSA)

N67-28218# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
WASHOUT COEFFICIENTS FOR SELECTED GASES AND PARTICULATES
R. J. Engelmann, R. W. Perkins, D. I. Hagen, and W. A. Haller 15 Apr. 1966 30 p refs Presented at the 59th Ann. Meeting of the Air Pollution Control Assoc., San Francisco, Calif.
(Contract AT(45-1)-1830)
(BNWL-SA-657; CONF-660648-1) CFSTI: HC$3.00/MF$0.65

Precipitation scavenging is the primary cleansing mechanism for airborne gases and fine particulates. Scavenging below cloud base, called washout, acts to remove these from pollution clouds. Advances in radiochemical techniques allow the measurement of such washout coefficients during natural rain and snow. Washout coefficients (fraction washed out per unit time) are presented for several gases as a function of precipitation rate. Deviations from theoretical predictions are discussed. Author (NSA)

N67-28220# Atomic Energy Establishment, Trombay (India).
INVESTIGATIONS ON THE BEHAVIOR OF PLUTONIUM
N. Srinivasan, M. V. Ramaniah, C. L. Rao, M. N. Namboodiri, P. R. Natarajan et al 1966 26 p refs
(AEET-265)

The results are presented of experiments carried out on the behavior of plutonium pertaining to assay of plutonium in aqueous and organic solutions; conditions for the formation of a third phase and recovery of plutonium from it; polymerization and redox reactions of plutonium (IV); and ion exchange purification of plutonium. Author (NSA)

N67-28231* International Information, Inc., Philadelphia, Pa.
NEW DETERMINATIONS OF THE MASSES OF METEOR BODIES [NOVYYE OPREDELENIYA MASS METEORNYKH TEL]
I. N. Kovshun Washington, NASA, Jan. 1967 13 p refs Transl. into ENGLISH from Geomagnetizm i Aeronomiya (Moscow), v. 6, no. 4, 1966 p 717–725
(Contract NASw-1499)
(NASA-TT-F-10690) CSCL 07B

A calculation is made of the masses of meteors photographed in Odessa, Dushanbe, and Cambridge, taking into account the dependence of the coefficients of radiation on mass, velocity, composition, and the structure of the meteors. Author

N67-28234* Scientific Translation Service, La Canada, Calif.
VAPORIZATION OF ACTINIDES AND THEIR COMPOUNDS. PART I: BASIC PROBLEMS IN VAPORIZATION STUDIES. VAPORIZATION OF ACTINIDES [VYPAROVANI AKTINIDU A JEJICH SLOUCENIN. I. ZAKLADNI PROBLEMY STUDIA VYPAROVANI. VYPAROVANI AKTINIDU]
I. Krivy Washington, NASA, May 1967 32 p refs Transl. into ENGLISH of a Report from Ustavu Jaderneho Vyzkumu, Prague, 1966
(Contract NASw-1496)
(NASA-TT-F-10903) CSCL 07B

A theoretical study of the vaporization process is carried out, including identification of the gaseous species, formulation of the net reactions, vapor-pressure measurement, study of kinetics and the vaporization process. Earlier measurements of actinide elements are reviewed. Author

N67-28235*# International Information, Inc., Philadelphia, Pa.
PHYSICAL CHARACTERISTICS OF SPECTRAL ANALYSIS WITH SAMPLING BY AN ELECTRIC DISCHARGE [K VOPROSU O FIZICHESKIKH OSOBENNOSTYAKH SPEKTRAL'NOGO ANALIZA S OTBOROM PROBY ELEKTRICHESKIM RAZRYADOM]
K. I. Taganov Washington, NASA, Jun. 1967 8 p ref Transl. into ENGLISH from Inzh-Fiz. Zh., Akad. Nauk Belorussk. (Minsk), v. 1, no. 7, 1958 p 54–60
(Contract NASw-1499)
(NASA-TT-F-10976) CSCL 07D

This paper deals with the theoretical analysis of "saturation" of the transfer of matter onto an auxiliary electrode, and the change of spectral line intensities during burning of the transfer products. The nature of spectral analysis on a steeloscope with sampling by an electric discharge is interpreted. An explanation is also given for the increase in the concentration sensitivity of quantitative analysis when photographing spectra whose intensities vary with time. A formula is derived for the relative concentration sensitivity whose second term is always positive, thus resulting in the sensitivity increase. Author

N67-28256# Massachusetts Univ., Amherst. Dept. of Chemistry.
RATES OF EXCHANGE OF SOLVENT MOLECULES WITH PARAMAGNETIC IONS Final Scientific Report
Thomas R. Stengle and Cooper H. Langford (Amherst Coll.) 10 Feb. 1967 16 p refs
(Grant AF-AFOSR-212-63)
(AFOSR-67-0663; AD-647953) CFSTI: HC $3.00/MF $0.65

Rates and mechanisms of solvent exchange reactions with paramagnetic transition metal ions in solution were investigated. Chemical shift and relaxation time techniques were developed and used to investigate the solvation of neutral complexes in mixed solvents. Solvent exchange rates with transition metal ions were derived from the temperature dependence of the O17 relaxation times of the dimethylformamide solvent. Author (TAB)

N67-28288*# Holman (John F.) and Co., Inc., Washington, D. C.
CALCULATING THE TRUE LINE CONTOUR OF THE RAMAN EFFECT BASED ON THE OBSERVABLE LINE CONTOUR [O NAKHOZHDENII ISTINNOGO KONTURA LINII KOMBINATSIONNOGO RASSEYANIYA SVETA PO NABLYUDAYEMONU]
M. M. Sushchinskiy Washington, NASA, Jun. 1967 12 p refs Transl. into ENGLISH from Zh. Eksperim. Teor. Fiz. (Moscow), v. 25, no. 1, 1953 p 87–94
(Contract NASw-1495)
(NASA-TT-F-10998) CSCL 07D

A general method is presented for finding the true profile of Raman scattering line from the observed profiles of the given line and of the exciting line. The results are used to find the profiles of lines in certain typical cases. Author

N67-28330# Cornell Univ., Ithaca, N. Y. Dept. of Chemistry.
MEASUREMENT OF RELAXATION TIMES OF CONCENTRATION FLUCTUATIONS BY THE ELECTRIC FIELD EFFECT ON CRITICAL OPALESCENCE
C. C. Gravatt 1 Apr. 1967 12 p refs Submitted for publication
(Contract Nonr-401(58))
(TR-2; AD-649343) CFSTI: HC $3.00/MF $0.65

Relaxation times of concentration fluctuations in a binary mixture were investigated by scattered light measurements of the electric field effect on critical opalescence. Experimental relaxation times were measured for the system nitrobenzene-isooctane for scattering angles from 30 to 135 deg. and for temperature distances above the critical temperature from 0.60C to 0.01C. Over the range of angles and temperatures employed the results follow the Fixman modification of the Debye theory of relaxation times. The temperature dependence is non-classical with a value of the Fisher gamma approximately 1.2. Author (TAB)

N67-28334# Naval Air Engineering Center, Philadelphia, Pa. Aeronautical Materials Lab.
RESEARCH ON POLYURETHANE RESINS FOR STRUCTURAL LAMINATE SYSTEMS Progress Report, Aug. 1966–Mar. 1967
H. J. Lee 16 Mar. 1967 12 p refs
(NAEC-AML-2593; AD-649349) CFSTI: HC $3.00/MF $0.65

The continuing search for polyurethane laminating resins possessing simultaneous high thermal and mechanical properties is described. Also discussed are systems that possess some superior property over those previously investigated and the attempts to overcome some problems in resin synthesis. Author (TAB)

N67-28335# Naval Air Engineering Center, Philadelphia, Pa. Aeronautical Materials Lab.
A RADIOCHEMICAL INVESTIGATION OF THE LEACHING OF CHROMIUM FROM CHEMICALLY CHROMATED ALUMINUM SURFACES, PART II
A. L. Glass 10 Mar. 1967 33 p refs
(NAEC-AML-2589; AD-649348) CFSTI: HC $3.00/MF $0.65

A radioactive tracer procedure is used to investigate the effect of elevated temperatures on the quantities of chromium dissolving from chemically chromated aluminum surfaces. An interpretation of the results is presented. Data are also presented showing the effect of film thickness, aging period, and time of exposure in salt water on the solution of chromium from chemical conversion coatings. Author (TAB)

N67-28342# Florida Univ., Gainesville. Dept. of Nuclear Engineering Sciences.
CHEMICAL STRUCTURAL STUDIES BY NUCLEAR TECHNIQUES
William H. Ellis and Ugur Ortabasi 1 Dec. 1966 34 p refs
(Contract AT(40-1)-3345)
(ORO-3345-2) CFSTI: HC $3.00/MF $0.65

The operational testing and performance of a system for studying the microstructure of liquids and solids by the use of extra-nuclear perturbation of angular correlation measurements are reported. Time dependent angular correlation measurements were performed with ^{181}HF polycrystalline metallic powder and liquid oxychloride sources with time dependent external field effects being observed in the case of the polycrystalline metal source. The application of relatively thin 3mm thick cylindrical type lithium-drifted germanium diodes for small-time jitter low-energy gamma coincidence spectrometry was evaluated. NSA

N67-28348# Cornell Univ., Ithaca, N. Y. Materials Science Center.
PARAMAGNETIC RESONANCE OF THE E-2 ($3d^3$) LEVEL IN MgO
Lloyd Lee Chase Feb. 1967 98 p refs
(Contract AT(30-1)-2150)
(NYO-2150-24) CFSTI: HC $3.00/MF $0.65

Electron paramagnetic resonance has been performed in the excited ^{2}E level of the ions Cr^{3+} and V^{2+} in the cubic coordination of MgO. The resonances were detected by means of the change in circular polarized fluorescence from ^{2}E along the applied magnetic field as a result of microwave saturation in this state. The observed resonances have a greatly anisotropic width, which is explained in terms of the combined effects of magnetic orbital interactions and local strains, both of which split the orbital degeneracy of ^{2}E. The magnitude and anisotropy of the resonance width fit closely to calculations of the magnetic splitting of ^{2}E using parameters obtained from optical investigations of these ions by other investigators. The resonances of Cr^{3+} showed sample-dependent asymmetries which are explained as resulting from selection rules for the circular polarized fluorescence from the strain-split orbital states at each site. The details of relaxation between the components of ^{2}E also play a role in this regard, and it is shown that greatly distorted resonances are expected for the case of direct process relaxation due to photons. The sample dependence of these effects is correlated with cross relaxation, which is evident from measured spin-lattice relaxation data. The nature of the cross relaxation is discussed on the basis of the evidence presented by the observed resonance shapes. A well-resolved hyperfine spectrum is observed for V^{2+} from which the orbital hyperfine contribution may be obtained. The measured

orbital hyperfine constant is found to agree within a few percent with the value calculated from the measured g shift and $(r^{-3})_{3d}$ obtained from the free ion Hartree–Fock wave functions for V^{2+}.
Author (NSA)

N67-28353# Arkansas Univ., Fayetteville. Dept. of Chemistry.
NUCLEAR AND COSMOCHEMISTRY ANNUAL PROGRESS REPORT
P. K. Kuroda 31 Jan. 1967 51 p
(Contract AT(40-1)-3235)
(ORO-3235-12) CFSTI: HC$3.00/MF$0.65

Developments are reported for studies on: nucleosynthesis models; fission; nuclear spectroscopy and decay schemes; cosmic-ray-induced nuclear reactions; geo- and cosmo-chemistry; and hot atom chemistry. NSA

N67-28390# Florida Univ., Gainesville. Dept. of Chemistry.
RESEARCH ON SYNTHESIS OF UNSATURATED FLUOROCARBON COMPOUNDS Semiannual Report, 1 Apr.–30 Sep. 1966
Paul Tarrant, Fred Drakesmith, O. J. Stewart, J. P. Tandon, and Susumu Misaki Oct. 1966 56 p refs
(Contract DA-19-129-AMC-79(N))
(SAR-7; AD-649346) CFSTI: HC$3.00/MF$0.65

The purpose of this project is to conduct the necessary research for the preparation of unsaturated organic compounds containing fluorine, and, when synthetic methods have been developed, to prepare various fluoroolefins which may give elastomers which are oil and fuel resistant and which retain their elasticity at low temperatures. The study of free radical addition of haloalkanes to olefins was continued. Dehalogenation and dehydrohalogenation of the adducts yielded new unsaturated compounds. The free radical addition of haloalkanes diallyl ether was investigated in an attempt to prepare fluoroethers. Unsaturated fluoro-organic lithium and magnesium compounds have been prepared and their reactions studied with a view to using these derivatives as reagents in the synthesis of new compounds containing the original fluoro-organic group. Author (TAB)

N67-28402 California Univ., Livermore. Lawrence Radiation Lab.
ANALYTICAL SECTION Quarterly Report, 1 Jul.–30 Sep. 1966
Jack E. Harrar, ed. 30 Nov. 1966 41 p refs
(Contract W-7405-ENG-48)
(UCID-15066) CFSTI: HC$3.00/MF$0.65

Developments in analytical equipment and methods and in direct determinations are reported. The methods include improvements in atomic absorption and flame emission, spectrophotofluorimetry, X-ray fluorescence, and cathodic etching. Modifications are described for special purpose gas chromatographs, inlet system for high sensitivity gas chromatograph, coincident field cycloid mass spectrometer, field operational differential mass spectrometer, helium densitometer, vacuum fusion equipment, and controlled-potential coulometer. Determinations include: Hf in Mo–Hf nitride alloys; Pb in Pb glass; trace W in Ag; trace Cl in fluoroelastomers; low-level Si in V–Si and Fe–Si alloys; trace fluorides in refractory alloys and metals; Hf in W; rare earth impurities in La; metallic impurities in W, Ta, and Mo; impurities in Re; trace impurities in gases; He diffusion rates; LiOH in LiH; C and S in refractory metals. The homogeneous precipitation of beryllium hydroxide, use of multichannel pulse height analyzer with electron microprobe; standards preparation line; primary pressure standards line; and cathodic etching to prepare metals for oxygen determination are also discussed. NSA

N67-28403# California Univ., Livermore. Lawrence Radiation Lab.
ANALYTICAL SECTION Quarterly Report, 1 Oct.–31 Dec. 1966
Jack E. Harrar, ed. Dec. 1966 40 p refs
(Contract W-7405-ENG-48)
(UCID-15079) CFSTI: HC$3.00/MF$0.65

Developments in the design of new equipment, methods, and actual determinations are reported. The equipment and methods include: atomic absorption spectrophotometry; automatic helium analyzer; mass spectrometer; X-ray fluorescence; spectroscopy; controlled-potential coulometer; vacuum fusion apparatus; gas chromatographs; and inlet system for gas chromatography. The determinations include: light elements in uranium compounds; helium diffusion rates; metallic impurities in W, Ta, and Mo; trace W in Ag; Mo in W; impurities in Re; Hf in W; trace fluorides in refractory metals and alloys; trace U in Ag; Ag in $AgNO_3$; Hf in Mo–Hf and Re–Hf alloys; Hf in W–Hf alloys; impurities in EDTA; Be in filtrates; and C and S in refractory metals. NSA

N67-28409# California Univ., Berkeley. Lawrence Radiation Lab.
KINETICS OF FORMATION OF XENON FLUORIDES
Clayton Fred Weaver (Ph.D. Thesis) Sep. 1966 114 p refs
(Contract W-7405-ENG-48)
(UCRL-17169) CFSTI: HC$3.00/MF$0.65

The temperature dependence of the near ultraviolet region of the absorption spectra of F_2 and XeF_2 was determined to 400°C in fluorinated nickel cells with calcium fluoride windows. That of XeF_4 was determined to 250°C. This spectral information was used to study the kinetics of the formation of XeF_2 and XeF_4 in the same temperature regions and in the same nickel cells. Experimental conditions were chosen to cause the reactions to terminate at XeF_2 or XeF_4. With a total pressure of reactants in the 10 to 40 mm range and Xe to F_2 ratios of 10 or more the reaction $Xe+F_2 \rightarrow XeF_2$ occurred. Under these conditions the reaction was zero order in Xe and first order in F_2 over the temperature range 190 to 400°C. With total reactant pressures of 10 to 20 mm and F_2 to Xe ratios of 16 or more the reaction $Xe+2F_2 \rightarrow XeF_4$ occurred with XeF_2 as an intermediate. Under these conditions in the temperature range 190 to 250°C the formation of XeF_2 was zero order in F_2 and first order in Xe, just the opposite of the results above. The formation of XeF_4 was zero order in F_2 and first order in XeF_2. The reactions were heterogeneous, even though they were very reproducible. The activation energies were uniformly low ranging from 12.8 to 15.7 kcal/mole. A mechanism involving adsorption and dissociation of F_2 on the NiF_2 surface is proposed. NSA

N67-28410# California Univ., Berkeley. Lawrence Radiation Lab.
THE MOLECULAR-BEAM ELECTRIC-RESONANCE SPECTRA OF LiF, NaF, and KCl
Craig D. Hollowell (Ph.D. Thesis) 7 Nov. 1966 69 p refs
(Contract W-7405-ENG-48)
(UCRL-17019) CFSTI: HC$3.00/MF$0.65

Radiofrequency spectra were observed in the low vibrational and rotational states of $^6Li^{19}F$, $^7Li^{19}F$, $^{23}Na^{19}F$, $^{39}K^{35}Cl$, and $^{39}K^{37}Cl$ by the molecular-beam electric resonance method. Microwave $J=1\rightarrow0$ transitions were also observed for $^{23}Na^{19}F$. Analysis of the spectra made possible the determination of accurate dipole moments, rotational constants, and nuclear hyperfine interaction constants. A polarizable ion model of the alkali halide molecules is presented. This model includes several effects, previously neglected, and successfully agrees with experimental data. Author (NSA)

N67-28411# Ceskoslovenska Akademie Ved, Rez. Ustav Jaderneho Vyzkumu.
ULTRAVIOLET AND VISIBLE SPECTRA OF ELECTRONS, UNSTABLE RADICALS AND IONS

A. Habersbergerova, I. Janovsky, and J. Teply Nov. 1966 108 p refs
(UJV-1625)

Data on the uv and visible absorption spectra of electrons, inorganic and organic radicals, and ions formed in radiolysis or photolysis of liquid and solid phases are tabulated. Spectra of electrons measured in water and in aqueous and nonaqueous solutions and those of inorganic glasses irradiated at 77°K are also included. 132 references are given for the period through 1965. NSA

N67-28413# Union Carbide Corp., Oak Ridge, Tenn. Y-12 Plant.
ANALYSIS OF ALUMINUM ALLOYS BY ATOMIC ABSORPTION
M. S. Dill 1 Mar. 1967 14 p refs
(Contract W-7405-ENG-26)
(Y-KG-37) CFSTI: HC $3.00/MF $0.65

A study was undertaken to find out whether atomic analysis could be applied to aluminum alloys without sacrificing accuracy and precision obtainable by wet chemistry. Determinations of Cu, Mg, Fe, Zn, Cr, Pb, Ni, and Mn were made on Alloy Type 87A. Results were consistent with wet-chemistry methods. NSA

N67-28422# Slovak Academy of Sciences, Bratislava (Czechoslovakia).
CALCULATION OF THE TECHNOLOGICAL PARAMETERS OF RADIATION CHEMISTRY APPARATUS
Mojmir Seliga 1965 21 p refs Transl. into ENGLISH from Jad. Energ., v. 11, 1965p 263–267
(BNL-TR-56)

A theoretically sound method of calculating the basis parameters of the characteristics of the interaction of gamma radiation with a reaction system is given. From these quantities the radiation–chemical yield was calculated. The method derived was applied to the calculation of the basic parameters for the radiation–chemical synthesis of γ-chloropropylsilane. The calculations were carried out by an approximate method which, however, was proved to give results not very different from the more exact and more complicated one. NSA

N67-28430# Atomic Energy Commission, Washington, D. C.
COMPOUNDS OF NOBLE GASES
Zdzislaw Bankowski, Andrzej Cybulski, and Jerzy Gremadowski 1965 29 p refs Transl. into ENGLISH from Wiadomosci Chemi., v. 19, Feb. 1965 p 95–131
(AEC-TR-6609)

The chemical synthesis of noble gas compounds is reviewed and the chemical and certain physical properties are outlined for KrF_2, KrF_4, XeF_2, XeF_4, XeF_6, XeF_8, for other more complex compounds of xenon, and for compounds of radon. The particulars of the structure, thermodynamics, and spectroscopy of the noble gas compounds are discussed, and the nature of the chemical bonding is considered theoretically. The possibilities of the existence of other noble gas compounds are discussed, and a few predicted compounds are mentioned. NSA

N67-28448# Atomic Energy Commission, New Brunswick, N. J.
THE PREPARATION OF SYNTHETIC BORON ISOTOPIC MIXTURES FOR MASS SPECTROMETRIC DETERMINATION
A. R. Eberle, M. W. Lerner, and C. J. Rodden May 1966 8 p refs
(NBL-232)

Isotopic boron standards at the 50 wt. % boron-10 and normal levels were prepared from enriched boron-10 and boron-11 boric acids. One normal level standard was made in sufficient quantity for future use. The preparation of these standards is described in detail. The calculated and measured mass spectrometric values of these standards do not differ significantly when examined statistically. Author

N67-28449# National Lead Co. of Ohio, Cincinnati.
DISSOLVING AND PRECIPITATING CARBIDES OF URANIUM
Francois Giraud-Heraud [1966] 5 p ref Transl. into ENGLISH from Compt. Rend. Acad. Sci. (Paris), v. 261, 1965 p 1308–1311
(NLCO-TR-8)

The carbides formed during the casting of U and its alloys are redissolved by heating to high temperature. After a rapid cooling from the liquid state or from L+UC region, they reappear in the form of dendrites or of fine precipitants oriented with respect to the solid solution. Author (NSA)

N67-28483# Massachusetts Inst. of Tech., Cambridge. Lab. for Nuclear Science.
CHEMISTRY PROGRESS REPORT
31 Dec. 1966 103 p refs
(Contract AT(30-1)-905)
(MIT-905-81) CFSTI: HC $3.00/MF $0.65

Developments are reported for studies in: nuclear chemistry; instrumental chemistry; uses of organic isotopes; and physical chemistry. NSA

N67-28495# Central Lab. for Radiological Protection, Warsaw (Poland).
THERMOLUMINESCENT PHOSPHORS FOR RADIATION DOSIMETRY
J. Roman, M. Wolska-Witerowa, and Z. Urbanowicz 1966 23 p refs
(CLOR-59-d)

Lithium fluoride and calcium fluoride phosphors with thermoluminescent properties were prepared from commercially available materials. The glow curves of the phosphors obtained by various methods are presented. Some preparation techniques having effect on phosphor thermoluminescent properties are considered. A simple thermoluminescent dosimetric system containing CaF_2–Mn phosphor, developed in this Laboratory was shown to be suitable to measure the gamma ray dose in milliroentgen range. Author (NSA)

N67-28496# Indiana Univ. Foundation, Bloomington. Research Div.
APPLICATIONS OF RADIOISOTOPES IN POLAROGRAPHY Progress Report
Fred Mattes and W. B. Schaap [1967] 19 p refs
(Contract AT(11-1)-256)
(COO-256-65) CFSTI: HC $3.00/MF $0.65

A method using radioisotopes in polarography was developed to study anomalous electrode reactions and to apply them to the analysis of dilute aqueous and nonaqueous solutions. In radio-trace polarography the observed radioactivity of a collected mercury sample at each applied potential is plotted vs. the applied potential. Cell designs are described. NSA

N67-28497# Du Pont de Nemours (E. I.) and Co., Aiken, S. C. Savannah River Lab.
PRECISE DETERMINATION OF OXYGEN IN CURIUM OXIDE BY INERT GAS FUSION–GAS CHROMATOGRAPHY
P. E. Doherty 9 Sep. 1966 9 p Presented at 10th Conf. on Anal. Chem. in Nucl. Tech., Gatlinburg, Tenn., 27–29 Sep. 1966
(Contract AT(07-2)-1)
(DP-MS-66-41; CONF-660933-3) CFSTI: HC $3.00/MF $0.65

Inert gas fusion–gas chromatography is shown to be a very precise, rapid method for determining the total oxygen content of a wide variety of compounds including curium oxide. The method was used as a primary means of determining the stoichiometry of these compounds. Author (NSA)

N67-28498# Du Pont de Nemours (E. I.) and Co., Aiken, S. C. Savannah river Lab.
MOESSBAUER EFFECT WITH Am^{241} SOURCES
J. A. Stone and W. L. Pillinger 1 Nov. 1966 11 p refs Presented at the Am. Phys. Soc. Meeting, Nashville, Tenn.
(Contract AT(07-2)-1)
(DP-MS-66-67; CONF-661208-3) CFSTI: HC $3.00/MF $0.65

Unusual characteristics observed in the Moessbauer spectra of several Am compounds are presented. Velocity spectra of a $^{241}AmO_2$ source were obtained at 77°K and at 4.2°K. At both temperatures major resonances were observed at 0 and 2.5 cm/sec. Also, a strong resonance at −4.1 cm/sec was present in the 4.2°K spectrum. The velocity spectrum of a metallic ^{241}Am source, of indeterminate composition, showed a very broad resonance centered at −1.1 cm/sec at 4.2°K. With $^{241}AmF_3$ a strong resonance at −4.4 cm/sec was observed at both 77° and 4.2°K. The association of the different lines observed with oxidation states is discussed. NSA

N67-28499# Du Pont de Nemours (E. I) and Co., Aiken, S. C. Savannah River Lab.
MOESSBAUER EFFECT IN Pa^{231}
W. L. Croft, J. A. Stone, and W. L. Pillinger 10 Nov. 1966 8 p refs Presented at the Am. Phys. Soc. Meeting, Nashville, Tenn.
(Contract AT(07-2)-1)
(DP-MS-66-68; CONF-661208-2) CFSTI: HC $3.00/MF $0.65

Nuclear properties that made ^{231}Pa a promising candidate to exhibit the Moessbauer effect are described. Moessbauer velocity spectra clearly demonstrate a Moessbauer effect in ^{231}Pa at 4.2°K, even though the apparent effect is very small (on the order of 0.1%). The spectra show a broad absorption centered at 0 cm/sec with some indication of its being a doublet. NSA

N67-28582# Johnston (W. H.) Labs., Inc., Baltimore, Md.
BASIC STUDIES IN RADIATION TECHNOLOGY Final Report, 1 Nov. 1961–30 Apr. 1966
30 Apr. 1966 257 p refs
(Contract AT(30-1)-2901)
(JLI-2901-75) CFSTI: HC $3.00/MF $0.65

Developments are reported for studies on: working theory for seeking ionic chain reactions; hydrazine formation in radiolysis of ammonia; ozone formation in radiolysis of oxygen; nitrous oxide dosimeter; ionic chain reactions in radiolysis of alcohol–olefin, amine–olefin, isobutylene–water, thiol–olefin, and silane–olefin systems. Vacuum gas handling systems, high pressure facility, radiation facilities, analytical instrumentation, and a coincidence mass spectrometer are discussed. The present status of radiation chemistry is outlined. NSA

N67-28607# General Electric Co., Philadelphia, Pa. Space Sciences Lab.
INVESTIGATION OF BONDING IN OXIDE-FIBER (WHISKER) REINFORCED METALS Quarterly Report, 18 Oct. 1966–18 Jan. 1967
W. Edwin Sauer, Willard H. Sutton, and Earl Feingold 31 Jan. 1967 28 p refs
(Contract DA-19-066-AMC-330(X))
(AMRA-CR-66-01/3; QR-3; AD-651190) CFSTI: HC $3.00/MF $0.65

Factors affecting the wetting and bonding of nickel to sapphire (alpha-Al2O3) were investigated in a continuing study. The effects on the wetting behavior .001 to 1.0 atomic percent of active metal additives to the nickel were studied in detail. A series of 35 sessile drop experiments were performed and the results were analyzed to determine some of the parameters which affect the wetting. The crystallographic orientation of the sapphire substrate and a locking-in of the contact angle had a profound influence on the measured contact angle, and this influence increased with increasing time at melting. Author (TAB)

N67-28610# Naval Research Lab., Washington, D. C.
USE OF THE HYSTERESIS LOOP METHOD TO STUDY THIXOTROPIC SUSPENSIONS. PART 2: ACETYLENE BLACK IN HYDRAZINE AND PYROGENIC SILICA IN LIQUIDS OF VARYING POLARITY
J. T. Leonard and R. N. Hazlett 21 Mar. 1967 36 p refs
(NRL-6509; AD-651022) CFSTI: HC $3.00/MF $0.65

The hysteresis loop method was used to study the flow properties of suspensions of acetylene black in hydrazine and of pyrogenic silica in n-decane, hydrazine, unsymmetrical dimethylhydrazine, n-propyl and isopropyl alcohols, and water. It was found that the acetylene black/hydrazine system behaved ideally, in that the plastic viscosity and yield stress values of these suspensions followed Arrhenius law at low concentrations and Weltman and Greens equation at higher concentrations. Of the silica suspensions tested, only the pyrogenic silica/n-decane system exhibited the same exponential dependence of plastic viscosity and yield stress on concentration as was found for the ideal thixotropic suspensions. The remaining silica suspensions either broke down irreversibly under high shear conditions or were otherwise unsuitable for study by the hysteresis loop method. Author (TAB)

N67-28632# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
RELATIONSHIP BETWEEN THE STEP-WISE STABILITY CONSTANTS OF COORDINATION COMPOUNDS AND THE NUMBER OF LIGANDS (ORGANIC LIGANDS)
Teng-Yung Ma 25 Jan. 1967 17 p Transl. into ENGLISH from Hua Hsueh Tung Pao (Peiping), no. 7, 1965 p 43–47
(FTD-HT-66-569; TT-67-61598; AD-650798) CFSTI: HC $3.00/MF $0.65

For a polydentate complex (chelate) a steric arrangement of the coordinating group in space produces a strong effect on log kn and n. The compound with a higher charged central ion (e.g. Ti(+4)) shows linear change but the compound with a lower charge central ion (e.g. Co(+2) and Ni(+2)) shows a nonlinear relationship between log kn and n. The result still could not be explained because lambda could not be calculated from the dipole moment of a coordinating group or the electrical charge of coordinating atoms in complex ions. However, the nonlinear relationship for the chelates could be shown by the semiempirical equation log k2 = log k1 -2(lambda(ln sq)-1). Author (TAB)

N67-28660*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
FLUID PHYSICS RESEARCH
In its Res. and Advanced Develop., Vol. II 31 Jan. 1967 p 441–485 refs (See N67-28641 15-34)

Microscopic methods are being used to study molecules and free radicals that may be present in planetary atmospheres or in space; and a low energy, high resolution electron impact spectrometer is described. Plasma sources are being produced that are capable of generating large volumes of high energy, steady state plasma for use in studying flow of partially ionized gases. A nonequilibrium generator study is reported, as are studies dealing with magneto-fluid dynamics, measurement and flow production techniques, shock waves and inelastic rate processes in plasma flows, flow stability and separation, heat transfer from ionized gas flows, geophysical fluid mechanics, plasma and convective heat transfer, and rarefied gas dynamics. M.W.R.

N67-28686# Naval Air Engineering Center, Philadelphia, Pa. Aeronautical Materials Lab.
STUDY OF SOLUTION DEOXYGENATION AND SPECIMEN PRETREATMENT TECHNIQUES FOR USE IN THE HYDROGEN PERMEATION APPARATUS
Joan G. Gionnoscoli 14 Mar. 1967 10 p refs
(NAEC-AML-2592; AD-651211) CFSTI: HC $3.00/MF $0.65

An electrochemical technique that was previously developed by Devanathan and Stachurski (Proc. Royal Soc. Va270 P80 1962)

for measuring the permeation rate of hydrogen through a palladium coated membrane of iron or steel shows promise as a method for determining the hydrogen embrittling characteristics of paint strippers. A program was therefore initiated to determine the reproducibility of the method, the first phases of which are reported. It was found that oxygen could be rapidly and effectively removed from the alkaline solution by treatment with helium and sodium sulfite. Pretreatment of the test specimen surfaces proved to be of value in increasing permeation currents and, in addition, improved the reproducibility of the method. TAB

N67-28690# Army Medical Biomechanical Research Lab., Walter Reed Army Medical Center, Washington, D. C.
SYNTHESIS OF ALKYL 2-CYANOPROPIONATES AND MEASUREMENT OF THEIR SPREADING COEFFICIENTS ON 1% AQUEOUS CASEIN AND ON WATER
Clarence W. R. Wade and Harold J. Porter Jan. 1967 12 p refs
(TR-6701; AD-651209) CFSTI: HC $3.00/MF $0.65

Methyl, n-butyl, and n-heptyl 2-cyanopropionates were synthesized by hydrogenation of the corresponding alkyl 2-cyanoacrylates (alpha-cyanoacrylates). Measurements of their spreading coefficients on 1% aqueous casein and on water show that they are similar to the alykl 2-cyanoacrylates and the alkyl cyanoacetates in their spreading characteristics. Author (TAB)

N67-28704 Gt. Brit. Ministry of Aviation, London.
MEASUREMENTS OF THE COMPLEX DIELECTRIC CONSTANT OF AQUEOUS GLYCERINE AND GLYCERINE–GELATINE GELS AT FREQUENCIES BETWEEN 100 Mc/s AND 15 Gc/s [MESSUNGEN DER KOMPLEXEN DIELEKTRIZITAETSKONSTANTE VON WASSERHALTIGEM GLYCERIN UND GLYCERIN–GELATINE–GELEN BEI FREQUENZEN ZWISCHEN 100 MHz UND 15 GHz]
R. Pottel Mar. 1967 8 p refs Transl. into ENGLISH from Z. Angew. Phys. (W. Berlin), v. 15, no. 6, 1963 p 501–505
(TIL/T-5693) CFSTI: HC $3.00

It was found that for glycerine with 13% wt. H_2O at 29°C the position curve of the dielectric constant satisfies the same relaxation equation as that of Davidson and Cole for pure glycerine. Measurements of gels with 0 to 20% wt. gelatine, from 20 to 60°C showed decreasing dielectric constant and longer relaxation times with increasing gelatine concentration. Author

N67-28752*# Aerotherm Corp., Palo Alto, Calif.
THE NON-NEUTRAL IONIZED CHEMICAL EQUILIBRIUM SUBROUTINE
Robert M. Kendall 4 May 1967 18 p refs
(Contract NAS2-3929)
(NASA-CR-73091; Rept.-67-13) CFSTI: HC $3.00/MF $0.65 CSCL 07D

This report describes the operation of the subroutine including the preparation of input, the communication between it and the calling routine, the general nature of the solution process, and the accuracy of the calculated derivatives. The subroutine was prepared for utilization with a general viscous shock layer program. It serves to isolate the complexities of the chemistry solution outside of the logic associated with the shock layer solution and thus to permit greater flexibility of operation. The subroutine treats a general chemical system composed of up to 25 arbitrarily selected molecules and ions. It evaluates the state based on assigned elemental composition, surplus or deficit of charge, pressure, and enthalpy (or temperature). The state evaluation yields composition, temperature (or enthalpy), and derivatives of these properties with respect to the input parameters. To accelerate its operation when coupled to the viscous shock layer, certain special features have been included. In addition to the thermodynamic state specification, certain terms appropriate to transport property evaluation are determined. Author

N67-28787*# George Washington Univ., Washington, D. C. Biological Sciences Communication Project.
BIBLIOGRAPHY ON APPLICATIONS OF ETHYLENE OXIDE
Donald E. Wright and Anne K. Serrell Jun. 1967 34 p refs
(Contract NSR-09-010-027)
(NASA-CR-84827) CSCL 07C

The bibliography is presented for engineers and scientists interested in ethylene oxide sterilization, and specifically in a decontaminating cycle of ETO applied to spacecraft surfaces following environmental testing. A permuted title index and an author index are also included. N.E.N.

N67-28793# Bureau of Mines, Tuscaloosa, Ala. Metallurgy Research Center.
HEAVY LIQUID CYCLONE CONCENTRATION OF MINERALS. I: A STUDY OF LIQUID CYCLONE VARIABLES INFLUENCING THE CONCENTRATION OF MINERALS
Robert B. Tippin and James Scott Browning Jul. 1967 36 p refs
(BM-RI-6969) CFSTI: HC $3.00/MF $0.65

The heavy liquid separation process was investigated to develop a means of concentrating minerals from natural ores. Various spodumene ores were tested in a 0.4-inch diameter cyclone using pure tetrabromoethane as the heavy liquid. Studies were initiated to examine the influence of (1) pulp density, (2) feed grade, (3) cyclone pressure, (4) cyclone apex opening size, (5) cyclone vortex finder opening size, and (6) mineral particle size on the separation efficiency. Each of these factors was found to affect the heavy liquid separation in some degree; the mineral particle size exhibited the greatest effect and the ore feed grade the least. Conditions necessary to yield an 85 percent spodumene concentrate with an 85 percent recovery were determined to be: 70 psig pressure, 10 percent solids, 0.08-inch apex opening, 0.11-inch vortex finder opening and a minimum amount of minus 200-mesh fines in the feed. Operation of multiple cyclones in series resulted in spodumene concentrates assaying over 90 percent and indicated mineral recoveries exceeding 90 percent. Author

N67-28799*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
OSCILLATOR STRENGTHS FOR RESONANCE LINES OF SOME SILICON AND SULFUR IONS
Sidney O. Kastner Apr. 1967 8 p refs
(NASA-TM-X-55802; X-614-67-238) CFSTI: HC $3.00/MF $0.65 CSCL 07B

Oscillator strengths for resonance lines of Si VI, VII, VIII, IX, X and S VIII, IX, XI, XII were computed using wave functions and energies obtained by the Hartree–Fock computer program, and the results are compared with previously published calculations. The calculation of intermediate coupling is described, and the results are tabulated. It is considered that at least part of the differences in data from different methods is due to the inclusion of the minor spin–spin and spin–other interactions. N.E.N.

N67-28811# Los Alamos Scientific Lab., N. Mex.
THE SEPARATION OF RHENIUM FROM COPPER, MOLYBDENUM, AND TUNGSTEN AND ITS SPECTROPHOTOMETRIC DETERMINATION
J. H. Landrum and A. L. Henicksman Jun. 1966 15 p refs
(Contract W-7405-ENG-36)
(LA-3550) CFSTI: HC $3.00/MF $0.65

Existing methods for the separation and spectrophotometric determination of rhenium were modified, applied, and critically evaluated for the determination of rhenium in metal samples containing large amounts of copper, molybdenum, and tungsten. In the method as developed, the rhenium was extracted into chloroform as tetraphenylarsonium perrhenate, following which a color was developed with furil dioxime and measured spectrophotometrically. Many of the ions reported to interfere in the original color method

are eliminated by the chloroform extraction. Copper, molybdenum, tungsten, and hydrofluoric acid may be present in large amounts, and nitrate ion can be tolerated to a lesser degree. In the raffinate from the chloroform extraction, molybdenum and tungsten were analyzed by an existing spectrophotometric procedure. Molybdenum was selectively extracted into pentyl acetate as the dithiol complex from a solution 6*N* in hydrochloric acid. The absorbance of the complex was measured in the organic solution. In the water phase from this extraction, tungsten was isolated by adjusting the acidity to 9*N* and reducing the tungsten with titanous chloride. The colored complex of tungsten with dithiol was also extracted into pentyl acetate and measured directly. The analysis of known mixtures of the three metals, containing, in addition, large amounts of copper, showed recoveries of at least 99% for each, and each had a calculated standard deviation for a single determination of 1%.
Author (NSA)

N67-28828*# IIT Research Inst., Chicago, Ill.
RESISTANCE OF POLYMERIC MATERIALS TO NITROGEN TETROXIDE
A. M. Stake 15 Mar. 1967 30 p refs Prepared for JPL
(Contract NAS7-100)
(NASA-CR-84844; IITRI-U6046-7) CFSTI: HC $3.00/MF $0.65
CSCL 07D

The mechanism and cause of nitrogen tetroxide attack on polymeric elastomers was studied by the effects of interaction, crosslinking, and structural variations in polymers. Mechanical changes in polymer strength were determined by creep measurements, permeability to N_2O_4, and chemical changes under N_2O_4 exposure. Results showed that a material which undergoes chain scission under exposure to N_2O_4 exhibited much larger irreversible elongation than before exposure; crosslinking kept the irreversible elongation in smaller dimension. Creep measurements under constant stress as a function of time gave the following results: polysiloxane formed a less flexible structure upon contact with N_2O_4; polyurethane exhibited definite degradation; and fluorinated ethylene propylene was altered little at 7 days exposure to N_2O_4. Several permeation cells have been built for future studies on polymer materials.
G.G.

N67-28856# United Kingdom Atomic Energy Authority, Harwell (England). Analytical Sciences Div.
THE DETERMINATION OF SELENIUM IN ZIRCONIUM–SELENIUM ALLOYS
T. Carter and A. Parker Dec. 1966 13 p refs
(AERE-R-5293) HMSO: 2s 6d

The alloy is dissolved in a mixture of nitric and hydrofluoric acids, and the excess fluoride is complexed with boric acid. A piazselenol is formed with 3,3'-diaminobenzidine; this is extracted into toluene and measured absorptiometrically. Interferences due to zirconium are eliminated by complexing with EDTA. The coefficient of variation is 1% at the 100 μg level, and quantities of selenium as low as 0.2 μg can be detected. No bias is apparent in the presence of zirconium.
Author

N67-28887# Uppsala Univ. (Sweden). Dept. of Physical Chemistry.
SUBSTITUENT EFFECTS IN THE *CIS-TRANS* ISOMERIZATION ABOUT THE CARBON-NITROGEN DOUBLE BOND
Gunnar Wettermark and Stig Claesson [1965] 18 p refs
(Contract DA-91-591-EUC-3586)
(SR-2; AD-648440) CFSTI: HC $3.00/MF $0.65

Ethanol solutions of N-benzylideneaniline derivatives were photoisomerized and the kinetics for the thermal relaxation was measured. This thermal reaction follows first-order kinetics and the rate constants correlate with the Hammett sigma constants. The effect of a substituent is considerably stronger when it is attached to the aniline ring than when it occupies the corresponding position on the benzaldehyde ring. This is in agreement with the non-planar model for N-benzylideneaniline, where the pi-electron system of the aniline ring interacts with the lone-pair electrons of the nitrogen atom.
Author (TAB)

N67-28906# Western Reserve Univ., Cleveland, Ohio. Ultrasonics Research Lab.
ULTRASONIC VIBRATION POTENTIALS IN TETRAALKYLAMMONIUM HALIDE SOLUTIONS
Raoul Zana and Ernest Yeager 1 Feb. 1967 16 p refs
(Contract Nonr-1439(04))
(TR-31;AD-650413) CFSTI: HC $3.00/MF $0.65

Ultrasonic vibration potentials were measured in tetraalkylammonium halides at 220 kHz. The experimental and theoretically predicted values are in good agreement at low concentrations. The concentration dependence can be explained in terms of cation-cation pairs and ion triplets provided the volumes of these aggregates are much less than the sum of the volumes of the separate ions. The partial molal volumes of the tetralkylammonium cations determined from vibration potential measurements are proportional to the cube of their radii as predicted by Hepler's equation with the proportionality constant close to that expected for spherical solute molecules which are large compared to the solvent molecules.
Author (TAB)

N67-28913# Western Reserve Univ., Cleveland, Ohio. Ultrasonics Research Lab.
QUANTITATIVE STUDIES OF ULTRASONIC VIBRATION POTENTIALS IN POLYELECTROLYTE SOLUTIONS
Raoul Zana and Ernest Yeager 1 Feb. 1967 49 p refs
(Contract Nonr-1439(04))
(TR-30; AD-650412) CFSTI: HC $3.00/MF $0.65

The propagation of ultrasonic waves through polyelectrolyte solutions gives rise to alternating potential differences (polyelectrolyte vibration potentials) within the solution. A theory for the effect is developed on the basis of the polymer bead model and the earlier theoretical treatment for ionic vibration potentials. Measurements of the polyelectrolyte vibration potentials at 220 kHz were carried out with polyacrylic acid and other polyelectrolytes as a function of concentration of polyelectrolyte, percent neutralization and the nature and concentration of added salts. The agreement between theory and experimental values is quantitative. Polyelectrolyte vibration potentials measurements appear capable of providing information concerning counterion bonding and the volumes of the monomer units within the polymer beads.
Author (TAB)

N67-28915# Pratt and Whitney Aircraft, East Hartford, Conn.
INVESTIGATION OF MECHANISMS FOR ELECTROCHEMICAL CATALYSIS Quarterly Report, 1 Nov. 1966–31 Jan. 1967
J. R. Aylward and S. W. Smith May 1967 25 p
(Contract DA-28-043-AMC-02205(E))
(ECOM-02205-3; AD-651194) CFSTI: HC $3.00/MF $0.65

A program is being conducted to investigate the mechanisms of electrocatalysis with respect to the anodic oxidation of selected fuels by novel electrocatalysts in acid electrolyte at temperatures below 150C and at ambient pressure. Conflicts had occurred in the data for silicides incorporated on gold and gold-plated current collectors, but investigation during the current quarter indicates that the conflicts resulted from platinum contamination. The study also showed that TiSi2 exhibits some activity for hydrogen and methanol oxidation. The electrochemical behavior of WSi2 in acid electrolyte was studied and was found to be similar to that of MoSi2. Both of these materials have tetragonal structures. VSi2 and TaSi2 have similar electrochemical characteristics and both have hexagonal structures. Experiments with platinum-doped TiSi2 electrodes indicates that relatively large amounts of platinum are required to obtain a catalytic activity which approaches that of an equivalent platinum sheet and that the utilization of the platinum is low. However, gold-platinum co-deposits on TiSi2 exhibit

markedly different behavior. The current obtained from the co-deposits as the ratio of gold to platinum was varied shows maxima at 50 and 70 weight percent of gold and a sharp minimum at 55 weight percent of gold. The maxima are higher than the levels of activity obtained with platinum alone. Author (TAB)

N67-28918# RAND Corp., Santa Monica, Calif.
BASIC ENERGY-LEVEL AND EQUILIBRIUM DATA FOR ATMOSPHERIC ATOMS AND MOLECULES
Forrest R. Gilmore Mar. 1967 50 p refs
(Contract ARPA-SD-79; ARPA Order 189-1)
(RM-5201-ARPA; AD-650470) CFSTI: HC $3.00/MF $0.65

Tables of the formation energies, dissociation energies, ionization energies, electronic energy levels, and vibrational level spacings for most atomic, diatomic, and triatomic molecules involving hydrogen, carbon, nitrogen, oxygen, and argon are presented. Many positively and negatively charged ions are included. Tables of the equilibrium fractional electronic-state populations, and graphs of the equilibrium constants for dissociation, ionization, and detachment for most of the atomic and diatomic species are appended. A brief discussion of the significance of such data precedes the tables and graphs. Author (TAB)

N67-28934*# Geophysics Corp. of America, Bedford, Mass. GCA Technology Div.
LABORATORY AND THEORETICAL INVESTIGATION OF CHEMICAL RELEASE EXPERIMENT Final Report, 8 Oct. 1965–10 Nov. 1966
J. Pressman, P. Warneck, A. Sharma, J. P. Padur, and H. K. Brown Feb. 1967 23 p refs
(Contract NASw-1341)
(NASA-CR-84871; GCA-TR-67-4-N) CFSTI: HC $3.00/MF $0.65 CSCL 04A

The highlights of theoretical and laboratory studies performed in support of chemical release experiments in the upper atmosphere are summarized. Chemiluminous reactions of trimethyl bismuth, trimethyl phosphorous, dimethyl mercury, and diethyl cadmium with atomic oxygen, atomic nitrogen, and ozone were examined. The relative intensities of these compounds were measured. The twilight fluorescence method of measuring atmospheric temperature was examined. The deactivation of $O(^1D)$ by O_2 and the charge exchange cross section of O^+ with O_2 and N_2 was measured. Studies were also made of the optical morphology of chemical release clouds as a function of scattering angle for clouds of intermediate opacity, the dynamic growth of particle clouds under conditions of various initial velocity distribution and drag laws, and the anomalous chemiluminescence rates observed for nitric oxide and atomic oxygen. The fluorescence calculations and preliminary laboratory measurements of the vibrational transitions were checked in a simulator. Also included are abstracts of papers which supported this work. R.N.A.

N67-28936*# National Bureau of Standards, Boulder, Colo. Cryogenics Div.
THE THERMODYNAMIC PROPERTIES OF DEUTERIUM
Rolf Prydz 18 Apr. 1967 93 p refs
(NASA Order R-06-006-046)
(NASA-CR-84873; NBS-9276) CFSTI: HC $3.00/MF $0.65 CSCL 07C

Thermodynamic data with tabular values of pressure, temperature, density, enthalpy, internal energy, and entropy are presented for both liquid and gaseous deuterium for pressures to 400 atm and temperatures between the triple point and 300°K. These tables are based on an equation of state and a vapor-pressure equation developed for this fluid. The equation of state is valid from the triple point to 425°K at pressures up to 400 atm. All the P-ρ-T data in the literature were critically evaluated. The equation of state was fitted to the data by weighted-least-squares. Measured and calculated density values were compared and deviations were calculated to illustrate the accuracy with which the equation of state represents the P-ρ-T surface of deuterium. Comparisons were also made of virial coefficients, Joule-Thomson inversion curve, and latent heat of vaporization with values calculated from the equation of state. Deviations between the vapor-pressure data and the values obtained from the vapor-pressure equation were determined. Two temperature-entropy charts and a compressibility factor chart for deuterium are included. Author

N67-28937*# City Coll. Research Foundation, New York.
FUNDAMENTALS OF THE OXIDATION PROTECTION OF COLUMBIUM AND TANTALUM Semiannual Report, 1 Oct. 1966–1 Apr. 1967
M. Kolodney and R. A. Graff 1 Apr. 1967 63 p refs
(Grant NGR-33-013-017)
(NASA-CR-84874; SAR-3) CSCL 07B

An investigation is being made of the processes involved in the protection of tantalum and niobium by their silicides. The efforts involve establishing thermochemical data for the silicides by means of a solid state electrochemical cell, determining the protection of both coating and substrate provided by the protective glass formed during oxidation, testing the oxidation rates and the possibility of using coating modifiers to promote the formation of glassy films, and examining the interactions between the silicide and substrate. The silicides are used in bulk form along with any required additives. Disks are fabricated by cold pressing and sintering. Specimens of over 90% theoretical density were obtained using these methods. Efforts have been mainly concerned with developing the fabrication techniques, the design and construction of equipment, and testing some of the methods to be used. Previous studies on the development of protective silicide coatings for tantalum and niobium are discussed along with methods and some preliminary results. R.N.A.

N67-28971# Naval Research Lab., Washington, D. C.
EFFECT OF ADSORBED WATER UPON THE SPREADING OF ORGANIC LIQUIDS ON SODA-LIME GLASS Interim Report
Elaine G. Shafrin and W. A. Zisman 24 Mar. 1967 29 p refs
(NRL-6496; AD-651056) CFSTI: HC $3.00/MF $0.65

Results are given of an investigation of the extent to which water adsorbed on a silicate glass surface affects the spreading and the equilibrium contact angle of various pure organic liquids. Of especial interest is the effect of the transition of the physically adsorbed water film from a polymolecular to a monomolecular film. These results can be related to the effect of adsorbed water on the spreading or adhesion of resins to glass and other hydrophilic solids and to the problem of developing better adhesives for dental fillings. TAB

07 COMMUNICATIONS

Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

N67-27824 Joint Publications Research Service, Washington, D. C.
THE BASIC SPEECH-TONE ANALYZER
K. S. Petrov *In its* Izv. VUZov: Instr. Bldg., Vol. 9, No. 6 27 Mar. 1967 p 10–13 refs (See N67-27821 15-14)

The operating principle of a device designed for observing the changes in the basic tone of speech is described. Author

N67-27834 Joint Publications Research Service, Washington, D. C.

OBTAINING AN ERASING CHANNEL IN SYSTEMS FOR REMOTE FREQUENCY-CONTROL

V. A. Astashin *In its* Izv. VUZov: Instr. Bldg., Vol. 9, No. 6 27 Mar. 1967 p 55–59 refs (See N67-27821 15-14)

Descriptive data are presented on a model of an erasing communications channel which assures a practically errorless transmission of frequency modulated signals along a low frequency communications line subjected to the action of pulse interference. Experimental data are given. Author

N67-27925# Selenia S.P.A., Rome (Italy).

FRONTAL IONIZATION PHENOMENA DURING THE ELDO SLV FLIGHT

D. Cunsolo and A. Gilardini Paris, ELDO, 15 Feb. 1965 115 p refs Prepared for ELDO

(ELDO-TR-2; TR-65/325) CFSTI: HC $3.00/MF $0.65

This report describes a theoretical study performed on the ionized environment surrounding the ELDO S.L.V., due to the frontal shock wave, and discusses its effects on the information transmissions to and from the vehicle. For this purpose the aerothermodynamic flow field has been determined in the forward sub-transonic zone of the spherical nose and in the supersonic-hypersonic zone around the cone-cylinder part of the vehicle. From this data, electron densities and collision frequencies have been evaluated, and used for the computation of signal losses and received noise power as a function of the incidence angle of the electromagnetic wave. Complete detailed calculations have been performed for three different flight heights and for the most perturbed radio link (136 Mc/s telemetry system on the satellite). Author (ESRO)

N67-27926# Selenia S.P.A., Rome (Italy).

ELDO-A VEHICLE: FRONTAL IONIZATION EFFECTS ON THE RADIATION OF THE THIRD STAGE TELEMETRY ANTENNAS

D. Cunsolo, P. De Santis, and A. Gilardini Paris, ELDO, 7 Dec. 1966 122 p refs Prepared for ELDO

(ELDO-TR-3; TR-66/347) CFSTI: HC $3.00/MF $0.65

The effects of the shock layer and frontal ionization on the third stage telemetry antennas of the ELDO-A vehicle are calculated. To this end the aerothermodynamic flow field and the electron densities around the antenna elements have been determined for the maximum shock ionization conditions occurring at the altitude of 62.5 km. The antenna mismatch and radiation pattern redistribution due to the above ionized environment are then calculated. The application of a negative bias of the order of tens of volts is found to act favourably to avoid both an excessive mismatch and the occurrence of breakdown at unacceptable power values. The radiated power below breakdown is, finally, determined not to appreciably affect antenna radiation characteristics. Author (ESRO)

N67-27929# European Space Technology Center, Delft (Netherlands).

COVERAGE BY A NETWORK OF TELEMETRY AND TRACKING STATIONS OF SATELLITES ON NEAR-EARTH ORBITS [COUVERTURE D'UN RESEAU DE STATIONS DE TELEMESURE ET DE TRAJECTOGRAPHIE DES SATELLITES PROCHES DE LA TERRE]

R. Fraysse Paris, ESRO, Feb. 1966 49 p ref In FRENCH; ENGLISH summary

(ESRO-TM-9) CFSTI: HC $3.00/MF $0.65

The discussion shows how the coverage of a telemetry or tracking station may be calculated by simple graphical or numerical methods, without resort to an electronic computer. Rates of coverage and zones of coverage are first defined, followed by a discussion of the principles underlying the methods employed. Formulae are then derived for the case of a satellite on a near-earth circular orbit. Finally it is shown how these formulae can be adapted for the case of a satellite on a near-earth elliptical orbit. Author (ESRO)

N67-27946# Army Electronics Labs., Fort Monmouth, N. J. Electronic Warfare Lab.

A NEW TYPE OF BROADBAND LOW NOISE RADIO FREQUENCY AMPLIFIER

Herbert Brett *In* Army Dept. Proc. of the 1966 Army Sci. Conf., Vol. I 26 Aug. 1966 p 79–88 refs (See N67-27941 15-34)

(AD-634663)

An RF amplifier is described that is capable of very wide bandwidth gain with very low noise figures, which are less than 1 db at room temperature. This phase shift amplifier has large dynamic range, singular freedom from spurious output, and both open and short circuit stability. It is a device in which the phase of an RF signal is made to vary by passage through an energy storage medium whose properties vary with the input signal voltage. A voltage variable capacitor or varactor diode is a common source of the energy storage element, and the basic concept of such a varactor diode phase shift amplifier is illustrated. Approaches to extending the frequency range of the phase shift amplifier are discussed, including its use as a video receiver. M.W.R.

N67-27959 Army Weapons Command, Rock Island, Ill. Future Weapons Office.

KINEMATICS OF A TRACKING GIMBAL

Wright K. Gannett *In* Army Dept. Proc. of the 1966 Army Sci. Conf., Vol. I 26 Aug. 1966 p 317–331 (See N67-27941 15-34)

(AD-634680)

Expressions are presented for the angular positions, velocities, accelerations, and torques required about the individual axes of a two-axis gimbal system in which a tracking device swivels universally to track a moving object. The basic formulas were derived by starting with the geometry of a specified hypothetical target tactic which permits determining if the capabilities in power, torque, acceleration, or speed are exceeded at any point. These formulas also relate the servo and control systems and fire control systems directly to a specified target tactic. It is considered necessary that gimbal and servo design for gimbaled trackers, control and human engineering problems of gimbaled trackers, and fire control problems of gimbaled weapons that engage moving targets be related to target tactics that can be specified during the design phase. Simplified methods for use by the designer are included. M.W.R.

N67-28012*# California Univ., Berkeley. Space Sciences Lab.

SOURCE ENCODING IN THE PRESENCE OF RANDOM DISTURBANCE

David J. Sakrison 2 Feb. 1967 9 p refs *Its* Ser. No. 8, Issue No. 4

(Grant NGR-05-003-143)

(NASA-CR-84658) CFSTI: HC $3.00/MF $0.65 CSCL 09D

A source encoding situation is considered with random quantities involved. The quantity $\mathbf{M}$ denotes a vector-valued random variable which represents the output of an ergodic source generated in an interval of time. Attention is focused on the nature of the ergodic source. In this instance the quantity $\mathbf{M}$ is denoted to indicate the direct relationship between the nature of the receiver output and the source output. S.P.

N67-28141 Joint Publications Research Service, Washington, D. C.

STUDIES IN RADIO WAVE PROPAGATION

4 May 1967 207 p refs Transl. into ENGLISH of Probl. Difraktsii i Rasprostraneniya Voln, v. Rasprostraneniye Radiovoln, Vypusk IV (Leningrad), 1966 p 4–183
(JPRS-40889; TT-67-31531) CFSTI: $3.00

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N67-28142 Joint Publications Research Service, Washington, D. C.

PROPAGATION OF LONG RADIO WAVES OVER THE SURFACE OF THE EARTH

E. M. Gyunninen and I. N. Zabavina *In its* Studies in Radio Wave Propagation 4 May 1967 p 1–27 refs (See N67-28141 15-07)

A mathematical expansion with respect to beams is used to solve a problem concerning long radio wave propagation over the surface of the earth. The problem of a magnetically active plasma, inhomogeneous with respect to altitude, was investigated. In the expansion solution, direct and diffracted beams are distinguished. In the first case, the corresponding integrals are calculated using the saddle point method, and the field is given in an approximation of the reflection formula. In the second case the field is given by numerical integration along the curves close to the curves of steepest descent. Boundary conditions are stated for the problems considered. L.S.

N67-28143 Joint Publications Research Service, Washington, D. C.

PROPAGATION OF MEDIUM LONG WAVES. CALCULATION OF REFLECTION COEFFICIENTS OF PLANE WAVES FROM AN INHOMOGENEOUS ANISOTROPIC PLASMA

N. S. Gavrilova and V. V. Kirillov *In its* Studies in Radio Wave Propagation 4 May 1967 p 28–48 refs (See N67-28141 15-07)

The problem is formulated as the reflection of plane electromagnetic waves from a flat layered and an anisotropic plasma. The propagation of stationary electromagnetic waves in such a medium is described by Maxwell equations jointly with the Lorenz equation of motion for electrons. The problem is reformulated into mathematical matrix elements as the determination of two linearly independent solutions of systems which decrease when the z axis approaches infinity. These solutions are sufficient for definition of the reflection coefficients. The influence of errors in the initial data on the calculation of these coefficients are investigated. The results obtained are graphically depicted, and offer the possibility of calculating the reflected fields under conditions which are approximate to real conditions. L.S.

N67-28144 Joint Publications Research Service, Washington, D. C.

SOME PROPERTIES OF NORMAL WAVES IN THE PROBLEM OF RADIO WAVE PROPAGATION IN THE EARTH IONOSPHERE WAVEGUIDE CHANNEL

G. I. Makarov and V. V. Novikov *In its* Studies in Radio Wave Propagation 4 May 1967 p 49–61 refs (See N67-28141 15-07)

Differential equations are used for solutions to the planar, spherical, and Greenberg models used for studying the properties of normal waves and eigenvalues in problems of radio wave propagation in the earth ionosphere waveguide channel for given boundary conditions. Equations for the three models are compared with each other for various frequencies and altitudes. L.S.

N67-28145 Joint Publications Research Service, Washington, D. C.

REFLECTION OF ELECTROMAGNETIC WAVES IN AN INHOMOGENEOUS ISOTROPIC ABSORPTION MEDIUM

B. V. Nerinovskiy *In its* Studies in Radio Wave Propagation 4 May 1967 p 62–70 refs (See N67-28141 15-07)

Asymptotic graphic representations of reflected electromagnetic waves in an inhomogeneous unbounded plane stratified isotropic absorption medium are presented. These were obtained from mathematical functions characterizing electron concentrations, frequency of collision of the electrons, and inductive capacitance. Numerical calculations were made for certain values of the functions for various angles, frequencies, and altitudes of the reflected wave. L.S.

N67-28146 Joint Publications Research Service, Washington, D. C.

PROPAGATION OF A PULSE SIGNAL IN THE EPSTEIN IONOSPHERIC LAYER

L. I. Bezruchenko and G. I. Makarov *In its* Studies in Radio Wave Propagation 4 May 1967 p 71–85 refs (See N67-28141 15-07)

Stationary and nonstationary strict solutions of problems involving the propagation of a pulse signal in the Epstein ionospheric layer, were examined. Mathematical expressions are presented in detail, and advantages of the Epstein model in studying the problem are shown. The model permits study of the influence of damping if an effective number of collisions is entered into the calculations, not taking into account the distribution of the number of collisions with altitude. L.S.

N67-28147 Joint Publications Research Service, Washington, D. C.

EXACT AND APPROXIMATE BOUNDARY CONDITIONS IN THE THEORY OF ELECTROMAGNETIC WAVE PROPAGATION

G. N. Krylov and A. D. Petrovskiy *In its* Studies in Radio Wave Propagation 4 May 1967 p 86–98 refs (See N67-28141 15-07)

Mathematical solutions to problems involving electromagnetic wave propagation over the surface of the earth, using both strict and approximate boundary conditions, are presented. Hertz vectors are represented in the expressions used. Several mathematical parameters and constants used in the calculations are defined. L.S.

N67-28148 Joint Publications Research Service, Washington, D. C.

THE FIELD OF A POINT DIPOLE OVER AN IMPEDANCE SURFACE

E. M. Gyunninen and G. I. Makarov *In its* Studies in Radio Wave Propagation 4 May 1967 p 99–123 refs (See N67-28141 15-07)

The behavior of an electromagnetic field over various layered media characterized by the surface impedances at their upper boundaries is investigated. This is significant for the theory of radio wave propagation where the impedance approximation frequently turns out to be entirely adequate. Attention is given more to the discovery of the limits of applicability of the impedance method than to the systematic study of the physical aspects of the matter; and this apparently explains why many facts either have remained unmentioned or have been discussed inadequately. Author

N67-28150 Joint Publications Research Service, Washington, D. C.

SURVEY OF WORKS CONNECTED WITH SUBTERRANEAN RADIO WAVE PROPAGATION

G. I. Makarov and V. A. Pavlov *In its* Studies in Radio Wave Propagation 4 May 1967 p 139–168 refs (See N67-28141 15-07)

The present article is a review of the basic factors influencing radio communication using antennae buried in the earth: geological formations, type and arrangement of transmitting and receiving devices, the curvature of the surface of the earth, the dependency of the electric parameters of rock on the frequency, temperature and pressure, the noise of the radio communications, etc. Basic theoretical and experimental works from the literature are investigated on radio wave propagation in the body of the earth. Author

N67-28151 Joint Publications Research Service, Washington, D. C.

NUMERICAL METHODS IN THE THEORY OF ELECTROMAGNETIC WAVE PROPAGATION. Part 1: STATIONARY CONDITION

G. N. Krylov *In its* Studies in Radio Wave Propagation 4 May 1967 p 169–180 refs (See N67-28141 15-07)

An algorithm for calculating the matrix element structure of the electromagnetic field of an arbitrary antenna system located above the earth with a finite conductance, was constructed. It was assumed that on the surface of the earth the approximate boundary condition of the impedance type is correct; and a compact diagram was constructed, which permits calculation on the basis of a minimum number of programs. Vertical and horizontal elements of the electric current; and final expressions for the electric and magnetic matrices elements were used for the construction. L.S.

N67-28152 Joint Publications Research Service, Washington, D. C.

THE EQUIVALENT SOURCES IN THE PROBLEM OF THE FIELD OF A MAGNETIC DIPOLE IN A TWO-LAYER MEDIUM

O. G. Kozina and K. F. Filippov *In its* Studies in Radio Wave Propagation 4 May 1967 p 181–191 refs (See N67-28141 15-07)

A two layer medium separated by a flat interface was investigated. In the lower halfspace there is a magnetic dipole arranged vertically or horizontally with respect to the interface. The upper halfspace may be an optically more dense or less dense medium by comparison with the lower halfspace. Sources were found which can replace the interface on reflection of the field from the media; and these calculated sources are useful for constructing approximate solutions of some diffraction problems (e.g. the problem of wave diffraction on a sphere and a cylinder located in a conducting medium in the presence of a flat interface). A list of formulae for vertical dipoles which may turn out to be useful in numerical calculations of electromagnetic fields is given. L.S.

N67-28250# Atlantic Research Corp., Alexandria, Va. Jansky and Bailey Engineering Dept.

INVESTIGATION AND ANALYSIS OF EMC RECEIVER CHARACTERISTICS

Richard P. Bertram Jul. 1966 313 p refs

(Contract NObsr-91373)

(Rept.-53-5309.02; AD-649100) CFSTI: HC $3.00/MF $0.65

The report contains the results of measurement investigations of the characteristics of test instrumentation which is normally used for fine-grain spectral measurements. Instruments included in this investigation were FSVMs and spectrum analyzers, specifically, the Empire Devices NF-105, Stoddart NM-62A, Polarad SA-84WAW, and Hewlett-Packard 851/8551. Characteristics measured include selectivity, sensitivity reduction, bandwidth limited time response, and pulse spectrum definition. Author (TAB)

N67-28267# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

WIDE-BAND DUMMY DIPOLE ANTENNA [SHIROKODLA-PAZONNYY EKVIVALENT VIBRATORNOY ANTENNY]

A. S. Knyazev and V. S. Shelonin 23 Jan. 1967 7 p Transl. into ENGLISH from Russian Patent No. 174676 (Appl. no. 806311/26-9, 4 Dec. 1962) 2 p

(FTD-HT-66-709; AD-649407) CFSTI: HC $3.00/MF $0.65

The proposed wide-band dummy dipole antenna consists of a section of coaxial line with a helical inner conductor made of a high-resistance alloy. The external conductor is a screen provided with apertures. This configuration increases the level of the dissipated power and provides for accurate reproduction of dipole antenna input impedance within a wide frequency range. Author (TAB)

N67-28268# Hughes Aircraft Co., Culver City, Calif. Aerospace Group.

AN INVESTIGATION OF A VARIABLE WAVEGUIDE COUPLER WITH 360 DEGREES OF PHASE CONTROL

B. J. Forman, A. F. Seaton, and C. H. Nonnemaker, Jr. Nov. 1966 47 p refs

(Contract AF 19(628)-4349)

(P67-01; HAC-A5034; SR-7; AFCRL-67-0090; AD-649128) CFSTI: HC $3.00/MF $0.65

A waveguide hybrid coupler was investigated that provides variable control over the phase and amplitude of a signal radiated from a waveguide slot. The control technique was studied theoretically and empirically in two devices, a mechanical unit that incorporated four micrometer-driven probes and an electronic unit that utilized four varactor diodes around the slot. Coupling levels up to -12.3 db were obtained over a 360-degree range of phase control with the mechanical unit and up to -23.0 db over a similar range with the electronic unit. It was found that simple driving functions on the control elements provided theoretically predictable slot phase control, but that coupling variations increased at the higher coupling levels. Author (TAB)

N67-28322# Naval Research Lab., Washington, D. C.
AN ANALYSIS OF A SYSTEM OF PULSE CODING FOR CLUTTER SUPPRESSION
John P. Barry and Dennis Herrin 22 Mar. 1967 38 p refs
(NRL-6559; AD-649464) CFSTI: HC $3.00/MF $0.65

A system of pulse coding to reduce the effect of ground clutter on airborne search radars was examined and found to be of questionable value for a search radar, although other applications may exist now and in the future. The system would suppress a selected group of lines in the transmitted spectrum by means of a proper combination of the amplitudes, phases, and pulse spacings of a small group of successive pulses. The conditions for this suppression are examined in detail for an infinitely long series of pulse groups, and it is found that with a group of N pulses, N-1 spectrum lines may be suppressed. These lines may be any group of N-1, but it is shown that if they are symmetrically placed about the carrier, the rf phase angles are phi and phi + pi radians. The first-order effects on the line suppression of variations from the nominal values of the parameters are analyzed, and it is shown that variations in the interpulse spacing must be kept below 1-1/2 parts in 100,000, the phase to within 0.1 degree, and the amplitude to within 1 part in 100,000 for reliable detection with a 40-db clutter-to-signal ratio. Finally, the effect of finite dwell time is examined, and it is shown that under the same conditions as above at least several thousand pulse groups need to be processed, which would require a time on target of about 18 sec.
Author (TAB)

N67-28326# Naval Weapons Lab., Dahlgren, Va.
MEASUREMENT OF ANTENNA NEAR FIELDS
R. I. Gray Mar. 1967 19 p refs
(W-7/67; AD-649027) CFSTI: HC $3.00/MF $0.65

The solutions of such problems as Hazards of Electromagnetic Radiation to Ordnance and radio frequency compatibility in the HF band require a near field measurement capability. Existing far field instruments are unsuitable for this purpose. A universal electromagnetic probe, which will measure the three vectors of an elliptically polarized HF field, is described and analysed.
Author (TAB)

N67-28423# Brookhaven National Lab., Upton, N. Y.
MICROWAVE SYSTEMS FOR SUPERCONDUCTING RF SEPARATORS
H. Hahn and H. J. Halama 17 Jun. 1966 11 p refs
(Contract AT(30-2)-GEN-16)
(BNL-11081) CFSTI: HC $3.00/MF $0.65

A microwave system for superconducting rf separators is described which can be used either in cw operation or on a long pulse length basis with only minor modifications within the servo loops. Since the power required by the cryogenic equipment will be proportional to unloaded $Q(Q_0)$ and the duty factor, a pulsed operation would be more economical. This is especially true if the final Q_0 is lower than expected. The lowest duty factor achievable depends on the desired pulse length, the time required to stabilize the phase and the filling time τ of the deflector. $\tau = Q_L/\omega$ and $Q_L = Q_0/(1+\kappa)$ where κ = coupling coefficient. In a superconducting structure κ can be made $>> 1$, the only limitation being the rf power that can be afforded to waste. Assuming a 200 millisecond pulse every 2.5 sec, one can easily operate the system at 30% duty factor.
NSA

N67-28514# Navy Underwater Sound Lab., New London, Conn.
TRANSIENT SIGNAL ANALYSIS BY MEANS OF ORTHONORMAL FUNCTIONS
Azizul H. Quazi 17 Feb. 1967 40 p refs
(USL-798; AD-648662) CFSTI: HC $3.00/MF $0.65

A preliminary quantitative analysis of transient signals of different amplitudes and durations was performed in an attempt to find a suitable approach to transient signal processing. The transient signals were assumed to fall into certain classes of waveform that can be described roughly by appropriate functions. It was found that a wide range of transient signals of different shapes can be accommodated by an orthonormal filter system based on the criterion of minimum energy in the error signal.
Author (TAB)

N67-28553# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
FUNDAMENTALS OF THE THEORY OF DETECTION OF RADAR SIGNALS AND MEASUREMENT OF THEIR PARAMETERS
Ya. D. Shirman and V. N. Golikov 25 Jan. 1967 394 p refs
Transl. into ENGLISH of the book "Osnovy Teorii Obnaruzheniya Radiolokatsionnykh Signalov i Izmereniya ikh Parametrov" Moscow, Izd. "Sov. Radio", 1963 p 1–278
(FTD-HT-66-256; TT-67-61671; AD-651073) CFSTI: HC $3.00/MF $0.65

The book deals with the basic aspects of the statistical theory of detecting radar signals and measuring their parameters in the presence of Gaussian interferences, gives the theory and the principles of designing devices with optimum detection and measuring as well as a great number of examples permitting the reader to familiarize himself more quickly with the main problems of the theory and its applications.
Author (TAB)

N67-28641*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
COMMUNICATIONS
In its Res. and Advanced Develop., Vol. II 31 Jan. 1967 p 237–252 refs (See N67-28641 15-34)

Combinatorial and probabilistic communication theory is being studied to discover new methods of generating and handling digital sequences that occur in space communication. Development status of a large lightweight erectable antenna for planetary spacecraft use is reported, as are block coding and synchronization studies. Factors affecting radar and radio propagation in interplanetary space are under investigation, and millimeter wave techniques and components for antenna and microwave engineering studies are being developed.
M.W.R.

N67-28652*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TRACKING AND DATA ACQUISITION
In its Res. and Advanced Develop., Vol. II 31 Jan. 1967 p 253–261 refs (See N67-28641 15-34)

A multipact and ionization study, quantum electronics research, and an advanced spacecraft transmitter cathode are considered in terms of tracking and data acquisition. The first study investigates voltage breakdown in RF components designed for space applications. The quantum electronics task is concerned with the evaluation of a space communications system based on a carbon dioxide laser having a carrier wavelength near 10μ. Advancing the state of the art in microwave power amplifiers for spacecraft transmitters is under consideration.
M.W.R.

N67-28721*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
COMPUTER PROGRAMS FOR ANTENNA FEED SYSTEM DESIGN AND ANALYSIS. VOLUME I: PROGRAMS AND SAMPLE CASES
A. Ludwig, ed. 15 Apr. 1967 175 p refs
(Contract NAS7-100)
(NASA-CR-84810; JPL-TR-32-979, Vol. I) CFSTI: HC $3.00/MF $0.65 CSCL 09F

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N67-28722*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MULTIMODE FEED PATTERN SYNTHESIS PROGRAM
A. Ludwig *In its* Computer Programs for Antenna Feed System Design and Analysis, Vol. I 15 Apr. 1967 p 1–4 refs (See N67-28721 15-07)

This program computes theoretical radiation patterns of a horn antenna aperture excited with a combination of cylindrical waveguide modes. Equations are formulated for the H-plane and E-plane; the factors in these equations result in a value near 0 db for the maxima of the individual mode patterns for unity coefficients. Any pattern obtainable with circular horn antenna excited with TE_{1n} and TM_{1n} modes ($n \leq 10$) may be synthesized with this program. It may also be used to match an experimental feed pattern by judicious choice of mode coefficients. Author

N67-28723*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
CASSEGRAINIAN SYNTHESIS PROGRAM
P. Potter *In its* Computer Programs for Antenna Feed System Design and Analysis, Vol. I 15 Apr. 1967 p 5–19 refs (See N67-28721 15-07)

This program synthesizes a theoretically realizable subreflector/feedhorn system that would provide maximum possible performance when used as a feed system for a paraboloidal antenna. Based on a few parameter inputs, the program generates the required subreflector surface, the required feedhorn radiation pattern, and various related parameters of interest to the user. The solution obtained is frequency-dependent and is an exact boundary value solution to the problem. The analytical formulation uses an orthogonal mode solution to the vector wave equation in spherical coordinates. Author

N67-28724*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PLOTTING PROGRAM
A. Ludwig *In its* Computer Programs for Antenna Feed System Design and Analysis, Vol. I 15 Apr. 1967 p 21–23 (See N67-28721 15-07)

This program plots radiation amplitude and phase patterns (or other data) using the IBM 1627 plotter. The grid that the program draws is identical in size to antenna pattern recorder chart paper. The E- and H-plane amplitude patterns are plotted on one grid (in decibels) and then phase patterns (in degrees) on a second grid. There is linear interpolation between data points. Program halts after completing each grid or pattern to allow a change of pens if multicolor plots are desired. Plotting is resumed by pressing start on console. Author

N67-28725*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DATA CONVERSION
A. Ludwig *In its* Computer Programs for Antenna Feed System Design and Analysis, Vol. I 15 Apr. 1967 p 25–26 (See N67-28721 15-07)

This program converts feed pattern data from format compatible with Programs III, IX, and XIV to format compatible with Program VI. Field values are converted from amplitude (in decibels or volts) and phase (in degrees) to real and imaginary parts (in volts). The polar angle PSI (in degrees) is converted to $PSI = \pi - PSI$ (in radians). Author

N67-28726*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SUBREFLECTOR PROGRAM
A. Ludwig *In its* Computer Programs for Antenna Feed System Design and Analysis, Vol. I 15 Apr. 1967 p 27–29 (See N67-28721 15-07)

This program generates binary-coded decimal punched cards for use in the Scattering Program (VI), describing a subreflector consisting of a vertex plate, a hyperboloidal section, and a flange. Subreflector must be a figure of revolution. Author

N67-28727*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SCATTERING OF AN ARBITRARY SPHERICAL WAVE BY AN ARBITRARY SURFACE OF REVOLUTION
W. V. T. Rusch *In its* Computer Programs for Antenna Feed System Design and Analysis, Vol. I 15 Apr. 1967 p 31–39 ref (See N67-28721 15-07)

This program computes the far-field scattering pattern of an arbitrary spherical wave scattered from an arbitrary surface of revolution. The phase center of the incident spherical wave must lie on the axis of symmetry of the scatterer. This incident field may be expressed as a truncated Fourier series in the azimuthal coordinate containing a fundamental and second, third, and fourth harmonics. The reflecting surface and the form of the incident field may be computed from analytical expressions (if available) or may be inputted into the computer in the form of discrete empirical data. The magnitude and phase of the incident field are described in terms of the real and imaginary parts of phasor functions of the polar coordinate. The magnitude, phase, and polarization of the scattered field may be computed in any azimuthal plane. Author

N67-28728*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PHASE-CENTER PROGRAM
W. V. T. Rusch *In its* Computer Programs for Antenna Feed System Design and Analysis, Vol. I 15 Apr. 1967 p 41–59 ref (See N67-28721 15-07)

The input consists of the real and imaginary parts of the E- and H-plane fields of an electromagnetic wave. Usually the input consists of the card output from the Scattering Program (VI). These fields are centered about some arbitrary origin. The program determines a best-fit phase center in terms of a distance from the origin (in wave-numbers) along the negative z-axis. The phase characteristic of the scattered wave is then determined with respect to the E- and H-plane phase centers. Author

N67-28729*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DATA CONVERSION
A. Ludwig *In its* Computer Programs for Antenna Feed System Design and Analysis, Vol. I 15 Apr. 1967 p 61–68 (See N67-28721 15-07)

This program converts output from the Scattering Program (VI) to format compatible with Programs III, IX, and XIV. Field values are converted from real and imaginary values (in volts) to amplitude (in volts) and phase angle (in degrees). The phase pattern as output from VI uses the phase center of the feed horn as the center of a spherical coordinate system; the phase center of the scattered pattern will normally be at the focal point of the paraboloid. The distance between the feed phase center and the expected phase center of the scattered fields is input to this program, and phase values are transformed to this new coordinate system. Usually, the expected phase center may be computed with geometrical optics. Since the scattered fields are computed for the far-field region, amplitude values are not affected by the coordinate transformation. Author

N67-28730*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ANTENNA FEED EFFICIENCY
A. Ludwig *In its* Computer Programs for Antenna Feed System Design and Analysis, Vol. I 15 Apr. 1967 p 69–71 ref (See N67-28721 15-07)

This program computes the efficiency of a circular paraboloidal antenna illuminated by a given feed pattern. Efficiency is relative to the case of uniform amplitude and phase illumination of the aperture, which is defined to be 100% efficiency. The equation for the illumination pattern is formulated. The program accepts the functions in tabular form, and typically the functions are obtained directly from experimental patterns. It may be used for predicting gain of a paraboloidal antenna with known illumination, for optimizing feed system parameters, for determining spatial energy distributions for a given feed pattern, or for directly computing the primary pattern gain of a given feed pattern. Author

N67-28732*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
UTkU/SCHMELE PARABOLOID RMS BEST-FIT PROGRAM
M. S. Katow and L. Schmele *In its* Computer Programs for Antenna Feed System Design and Analysis, Vol. I 15 Apr. 1967 p 75–82 refs (See N67-28721 15-07)

This program computes the coefficients for the equation of a paraboloid of revolution that best fits, in the least-squares sense, a set of coordinates representing points on the surface of a deformed paraboloidal antenna. The distortions, calculated with respect to the points on the best-fitted perfect paraboloid described above, are the normal and the path length errors. From the distortions, a weighted rms of one-half the path length error is computed. A rigid body fit, i.e., a fit without a change in focal length of best-fitting paraboloid, is made initially; this is followed by a best fit that includes the focal length change. From the computed vertex position and rotation of the symmetrical axis (z-axis) of the best-fit paraboloid, the RF boresight may be calculated. Author

N67-28733*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
BEST-FIT PARABOLOID PROGRAM
C. Lawson *In its* Computer Programs for Antenna Feed System Design and Analysis, Vol. I 15 Apr. 1967 p 83–106 ref (See N67-28721 15-07)

For this program, a paraboloid is parameterized by a set of nine numbers, which will be called the parameter vector. The principal input data for this problem is a set of x–y–z coordinates representing observed or computed points lying on some structure (typically an antenna surface). The problem is to determine the parameter vector identifying the paraboloid which best fits the given data. Two different critera of fit are available in this program. The subroutine ZFIT minimizes the weighted sum of squares of residuals measured parallel to the axis of the fitted parabola. The subroutine PFIT minimizes the weighted sum of squares of residuals measured as radiation path length errors. Author

N67-28734*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
RADIATION PATTERN PROGRAMS
D. Bathker *In its* Computer Programs for Antenna Feed System Design and Analysis, Vol. I 15 Apr. 1967 p 107–141 refs (See N67-28721 15-07)

Each program numerically evaluates the scalar far-field radiation pattern integral by a trapezoid rule approximation. The secondary radiation pattern of a large paraboloidal antenna is obtained given the feed amplitude and phase and reflector surface characteristics. Reflector surface distortion input for Program 5338 is specified as full RF path length error at points in a cylindrical coordinate system. Reflector surface distortion input for Program 5345 is specified as x-, y-, z-deflections at points in a rectangular coordinate system. The feed amplitude function W(I, J) input is defined to be the feed pattern (positive or negative field), and Program 5338 forms the aperture illumination. Program 5345 amplitude W(I, J) input is defined to be the aperture illumination (positive field only). With the final exception of an added case identification card in Program 5338, the programs are otherwise identical. Author

N67-28735*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ANTENNA NOISE TEMPERATURE PROGRAM
T. Y. Otoshi and C. T. Stelzried *In its* Computer Programs for Antenna Feed System Design and Analysis, Vol. I 15 Apr. 1967 p 143–161 refs (See N67-28721 15-07)

This program computes the zenith antenna temperature from antenna radiation patterns and antenna environment brightness temperatures. The probable error of the antenna temperature is also computed from the probable errors of the input data. The program is presently restricted to a special antenna case for which the following basic requirements must be fulfilled: (1) the antenna must have circular physical symmetry, (2) the antenna aperture is excited by only TE_{1n} and/or TM_{1n} cylindrical waveguide modes, and (3) the antenna is situated in an environment where the brightness temperature profile changes only with respect to the antenna polar angle variable θ. Although the last requirement would be difficult to fulfill in practice, the condition is nearly realized by a zenith-oriented antenna in a flat ground environment. Author

N67-28736*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
COMPUTER PROGRAMS FOR ANTENNA FEED SYSTEMS DESIGN AND ANALYSIS. VOLUME II: PROGRAM LISTINGS
A. Ludwig, ed. 15 Apr. 1967 70 p ref
(Contract NAS7-100)
(NASA-CR-84813; JPL-TR-32-979, Vol. II) CFSTI: HC $3.00/MF $0.65 CSCL 09F

A library of computer programs for antenna feed system design and analysis is listed. The programs cover a large spectrum of feed design problems, from primary feed pattern synthesis to the far-field pattern of the main reflector, including analyses of structural distortions. Author

N67-28747*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE INFLUENCE OF TRACKING STATION LOCATION UNCERTAINTIES ON SATELLITE ORBIT ERRORS
D. W. Koch 5 Apr. 1967 12 p refs
(NASA-TM-X-55804; X-507-67-207) CFSTI: HC $3.00/MF $0.65 CSCL 17I

Results of a study to investigate the effect of varying station location uncertainties upon RMS errors in spacecraft position and velocity are presented. RMS errors in the state vector are evaluated for four different sets of earth orbits using five different station location uncertainties. A comparison of the RMS errors in the state vector with and without station location uncertainties is then made. In addition, the effect of different orbital eccentricity, perigee height, and inclination upon RMS errors is studied. Author

N67-28807# Royal Aircraft Establishment, Farnborough (England).
AN INTEGRAL EQUATION EIGENFUNCTION PROBLEM CONCERNING THE ABILITY OF A RADAR TO DISTINGUISH BETWEEN TWO TARGETS
R. P. Muddle Nov. 1966 18 p ref
(RAE-TR-66348) CFSTI: HC $3.00/MF $0.65

Once the required performance of a radar has been specified by its ambiguity function, there exists an optimum emitted signal which most closely satisfies this requirement. The signal is the eigenfunction corresponding to the dominant eigenvalue of an integral equation. A numerical method is used to determine this eigenfunction and to evaluate the actual ambiguity function of the system using this signal. Author (ESRO)

N67-28808# Federal Aviation Agency, Washington, D. C.
DEVELOPMENT OF HEATED COMMUNICATIONS ANTENNAS Final Report
Oscar T. Grann and Ellis E. Shafer Dec. 1966 19 p
(RD-66-101)

Methods to reduce communications antenna icing were investigated. As a result, a new high-gain UHF antenna was developed and electrical heating elements were developed for application to swastika and disc–cone antennas presently in use. A brief history of the antenna icing problem is included. The electrical heating elements developed for application to presently used antennas are made of silicone rubber. They are relatively inexpensive and do not affect the radiation pattern or radiation impedance of the antenna. Three different types of heaters are available for application to swastika and disc–cone type antennas which experience severe icing problems in many locations. They have been field tested and found to be effective in reducing the formation of ice on the antennas. The new high-gain UHF antenna has heating elements imbedded in a fiberglass radome. It also utilizes vertical radiation pattern compression with a slight beam uptilt to increase coverage. This antenna has also been field tested and found to be effective in preventing antenna icing and in providing improved coverage. Author

N67-28835*# Alabama Univ., University. Systems Engineering Group.
EXPERIMENTAL ANALYSIS TO DETERMINE THE NUMBER OF REQUIRED CALIBRATION LEVELS AND SAMPLES AT EACH LEVEL FOR THE FM/FM TELEMETRY SYSTEM
Marvin A. Griffin, Richard S. Simpson, H. Paul Hassell, Jr., Der-san Chen, and Hui-chuan Juan Aug. 1966 103 p refs
(Contract NAS8-20172)
(NASA-CR-84831; TR-16) CSCL 09F

A methodology is developed to determine the mathematical model which relates input to output of a telemetry system; a simulation model reflecting the linearity characteristics of the true system is employed. Three levels of random noise are recognized as existing in the system. These three levels are respectively considered for the second, third, and fourth degree coefficients of the simulated polynomial relation. The regression analysis, with orthogonal polynomials technique, is used to find the curve providing the adequate fit. To determine the optimal calibration levels and sample size at each level, analysis of variance in conjunction with Duncan's Multiple Range Test is employed. Under the simulated experimental conditions, two calibration steps with fifteen samples at each step is significantly better than other techniques. Author

08 COMPUTERS

Includes computer operation and programming; and data processing. For basic research see: 19 Mathematics.

N67-27812 Atomic Energy Establishment, Winfrith (England). General Reactor Physics Div.
THE FLIC1 CONVERSION CODE
J. C. Basher Aug. 1964 23 p refs
(AEEW-M467) HMSO: 2s 6d

This memorandum describes the FORTRAN II program, FLIC1, which converts programs written in one dialect of FORTRAN to another dialect of the same language. Particular translation processes considered are those from existing dialects (FORTRAN II and S2) to EGTRAN$_1$—the dialect to be used initially on the Winfrith KDF9. The basic version of the program replaces FII or S2 statements where these are different from, but in one-to-one correspondence with, E$_1$ statements. Other statements which need changing are flagged. Author

N67-27830 Joint Publications Research Service, Washington, D. C.
CONCERNING THE ACCURACY OF CONTACTLESS CODE-DIRECT CURRENT CONVERTERS
D. T. Tsankov *In its* Izv. VUZov: Instr. Bldg., Vol. 9, No. 6 27 Mar. 1967 p 35–38 refs (See N67-27821 15-14)

Under consideration is the circuit of a contactless code–dc converter which provides a steady input resistance irrespective of the specified code combination. The static error of the converter of a binary code into direct current is estimated. Author

N67-27836 Joint Publications Research Service, Washington, D. C.
GENERALIZED ESTIMATE OF QUALITY OF COMPUTERS DESIGNED AS REQUIRED BY THEIR SPECIFICATIONS
A. N. Lebedev *In its* Izv. VUZov: Instr. Bldg., Vol. 9, No. 6 27 Mar. 1967 p 65–68 (See N67-27821 15-14)

Under consideration is the estimate of the quality of executing the design of computers. The proposed method makes it possible to estimate the degree of conformity of the design with the specifications and to compare various versions of the projected machines. Author

N67-27837 Joint Publications Research Service, Washington, D. C.
DIGITAL MODELING OF THE METHOD OF RECOGNITION OF STANDARD CHARACTERS
A. F. Gorshkov, V. M. Kirpichnikov, and N. S. Siunov *In its* Izv. VUZov: Instr. Bldg., Vol. 9, No. 6 27 Mar. 1967 p 69–71 refs (See N67-27821 15-14)

A method of reconciling recognized and standard symbols is described. A digital computer is used for modeling this method. Author

N67-27839 Joint Publications Research Service, Washington, D. C.
EFFECT OF PARAMETERS AND OF SWITCHING CONDITIONS ON THE STABILITY OF SIGNALS FROM FERRITE CORES WITH RECTANGULAR HYSTERESIS LOOPS
V. N. Sorokin *In its* Izv. VUZov: Instr. Bldg., Vol. 9, No. 6 27 Mar. 1967 p 75–79 refs (See N67-27821 15-14)

Certain results are given of calculating with an electronic digital computer the relationships between the instability of the maximum value of the output signal from a core with a rectangular hysteresis loop, the time of appearance of a maximum, and the switching conditions. The calculations show the form of the switching current pulse. Author

N67-27840 Joint Publications Research Service, Washington, D. C.
LOGIC CIRCUITS USING MULTIPATH MAGNETIC DEVICES
P. A. Sokolov *In its* Izv. VUZov: Instr. Bldg., Vol. 9, No. 6 27 Mar. 1967 p 80–84 refs (See N67-27821 15-14)

The prospects of using purely magnetic logic circuits are considered. Design trends using a single magnetic block for digital systems are discussed, along with the most promising method of controlling the magnetic flux. Author

N67-27842 Joint Publications Research Service, Washington, D. C.
FUNCTIONAL DIGITIZER ARRANGED AS A DECODER-CODER
E. S. Moskalev, and L. Ya. Novosel'tsev *In its* Izv. VUZov: Instr. Bldg., Vol. 9, No. 6 27 Mar. 1967 p 91-96 refs (See N67-27821 15-14)

It is shown that the pyramidal arrangement of the decoder makes it possible to use more information from its intermediate stages. In this manner, the total required equipment may turn out to be less than for the most economical stage-type arrangement, because it offers more possibilities of using less equipment in building a functional digitizer for a specific function. Author

N67-27843 Joint Publications Research Service, Washington, D. C.
DEBUGGING PROGRAM FOR TRAINING COMPUTERS
I. R. Kramfus, and S. S. Yakushin *In its* Izv. VUZov: Instr. Bldg., Vol. 9, No. 6 27 Mar. 1967 p 97-100 refs (See N67-27821 15-14)

A debugging program designed for working programmers with little experience is described. Author

N67-27853 Joint Publications Research Service, Washington, D. C.
ERROR DETECTION IN BINARY COUNTERS BY MEANS OF MODULO CHECKING
V. N. Nomokonov and I. L. Yershov *In its* Izv. VUZov: Instr. Bldg., Vol. 9, No. 6 27 Mar. 1967 p 147-151 refs (See N67-27821 15-14)

A method is described of detecting errors in binary counters by means of modulo checking. With this method the most effective modulo values for detecting errors with specified multiplicity are selected. Author

N67-27898 United Kingdom Atomic Energy Authority, Harwell (England). Electronics and Applied Physics Div.
OPERATING INSTRUCTIONS FOR PDP8 ASSOCIATIVE ANALYSER
G. C. Best Oct. 1966 45 p
(AERE-M-1815) HMSO: 6s

Operating instructions for the PDP8 associative analyzer program are given together with detailed program listings. Author

N67-27899 Atomic Energy of Canada, Ltd., Chalk River (Ontario).
MODIFYING THE PDP-8 DIGITAL COMPUTER FOR INDEXED ADDRESSING TO AID PROGRAMMING
K. R. Morin and A. D. Lightstone Feb. 1967 14 p ref
(AECL-2621)

The program limitation of the PDP-8 digital computer due to its 128 word "page" size is discussed. In order to overcome this limitation the computer was modified to allow a type of indexed addressing, whereby an external 12 bit index register defines the starting address of a block of memory 128 words long. This block or "floating page" can be referenced from anywhere in memory, but only by the four instructions: AND, TAD, ISZ and DCA, when the "page bit" of the instruction is a 1 and the external one bit mode register is set for modified (indexing) operation. Both the mode register and the index register can be loaded by the program, but the index register cannot be incremented. The PAL III assembler was modified to generate the proper codes for programs which use the floating page feature. In such a program, the start of the floating page must be indicated by a special origin setting. Author

N67-28000 United Kingdom Atomic Energy Authority, Harwell (England). Electronics and Applied Physics Div.
IMPROVING PDP8 DISPLAY RATES BY HARDWARE
G. C. Best Jan. 1967 8 p
(AERE-R-5358) HMSO: 1s 9d

A register unit is described which allows rapid extraction of display data from a PDP8 computer used as an analyser with 1-1/2 words (18 bits) per channel. This technique is compared with direct program methods, and is shown to result in substantial increase in display rates. Author

N67-28092# Sacramento Air Materiel Area, McClellan AFB, Calif. Service Engineering Div.
PROBLEM SOLVING WITH JOSS
E. P. Gimble Aug. 1966 59 p
(AD-649382) CFSTI: HC $3.00/MF $0.65

JOSS is a computing aid interacting with the user by means of a simple language. The aim of this report is to acquaint users with the language and the manner of interaction to immediately enable them to solve problems on JOSS. The report enumerates the commands and shows by examples and discussion JOSS's response to each of them. The user should be able, with an understanding of these basic principles, to solve progressively more involved scientific problems. Author (TAB)

N67-28117 Joint Publications Research Service, Washington, D. C.
MODEL OF HIGH-SPEED REGISTER WORKING ON PULSE LAMP
V. M. Kirpichnikov, A. F. Gorshkov, and M. N. Siunov *In its* Izv. VUZov: Instr. Bldg., Vol. 9, No. 2 23 Feb. 1967 p 81-85 refs (See N67-28101 15-14)

A description is presented on the logic and operating principle of a working model of a register functioning on pulse lamps. This is designed for high-speed removal of information in digit and alphabet form from an electronic digital computer. Author

N67-28120 Joint Publications Research Service, Washington, D. C.
DEVICE FOR TRANSFERRING BINARY INTO DECIMAL CODE WITH INDICATION OF TRANSFORMATION RESULTS
V. P. Murav'yev *In its* Izv. VUZov: Instr. Bldg., Vol. 9, No. 2 23 Feb. 1967 p 94-99 refs (See N67-28101 15-14)

Formulas for converting a binary to a decimal code are presented, along with functional and circuit diagrams of code converters. A solution to the code conversion problem is proposed. This is based on the use of electroluminescent digital display units which require little power, and ferrite diode circuits which have high flexibility and load capacity. M.G.J.

N67-28156# Joint Publications Research Service, Washington, D. C.
CYBERNETICS IN ECONOMICS—ON ONE ITERATIVE METHOD OF SOLVING PROBLEMS OF INTEGRAL PROGRAMMING
I. I. Pyatetskiy-Shapiro, V. A. Volkonskiy, L. V. Levina, and A. Pomanskiy *In its* Cybernetics in Economy and Ind. 1 Mar. 1967 p 1-5 refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 169, no. 6, 1966 p 1289-1292 (See N67-28155 15-10)

The algorithm was used as the basis for calculating several versions of the problem of selecting optimum construction terms and distribution of capital in oil drilling equipment supply branches. Mathematically the problem is adapted to the usual problem of

integral programming. The solution is described, and is conceived of as a random walk corresponding to a certain Markov chain. Results are obtained in examples for given orders, and the solutions are compared to optimized ones. To estimate the effectiveness of the algorithm, an experiment was conducted with an example of a simple structure where N=50 and m=3. L.S.

N67-28157# Joint Publications Research Service, Washington, D. C.
INTERMITTENT-ACTION PNEUMATIC COMPUTER ENGINEERING
E. V. Fudim *In its* Cybernetics in Economy and Ind. 1 Mar. 1967 p 6–10 ref Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 169, no. 6, 1966 p 1293–1295 (See N67-28155 15-10)

A method of computing by pneumatic computer is described, which permits high precision and technically simple basic computing operations, with linear remote control pneumatic resistance and other elements built on this basis. The essence of the method consists in the use of the law of gaseous state, in accordance with which, for a given gas (the gas constant is R_r=const.) and a certain temperature θ, there exists a single-value dependency between the three gas parameters: absolute pressure P, the volume/capacitance V, and weight G: $PV=GR_r\theta$. This equation, suitable for actual gases within wide limits of pressure changes, allows the possibility of high precision in computing for any applied diapazons of pressure without using any converters at all. Its solution can be thereby very simply and accurately obtained with the use of pneumatic capacitance, which is the ideal model of the given equation. Author

N67-28195# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PNEUMATIC LONG-TERM MEMORY CELL FOR DISCRETE SIGNALS [PNEVMATICHESKIY BLOK DOLGOVREMENNOY PAMYATIDISKRETNYKH SIGNALOV]
R. Yu. Fedoseyev and I. O. Golovanova 31 Jan. 1967 7 p Transl. into ENGLISH from Russian Patent no. 168543 (Appl. No. 859097/26-24, 30 Sep. 1963) 2 p
(FTD-HT-67-13; AD-649417) CFSTI: HC $3.00/MF $0.65

A brief description is given of a pneumatic long-term memory cell for discrete signals which contains two perpendicularly arranged slave mechanisms converting pressure into shifting and a lock, which has the distinguishing feature that, for the purpose of simplifying the device and improving the dependability, the lock is designed in the form of a projection located on a rod of the slave mechanism and two slots arranged on the rod of the other slave device. English translation. Author (TAB)

N67-28198# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ON THE POSSIBILITY OF ACCELERATED INFORMATION EXCHANGE BETWEEN MEMORY UNITS [O VOZMOZHNOSTI USKORENNOGO OBMEA INFORMATSIYEY MEZHDU ZAPOMINAYUSHCHIMI USTROYSTVAMI]
A. I. Dolgov and Yu. P. Zhuravlev 18 Jan. 1967 13 p Transl. into ENGLISH from Avtomat. Upravlenie i Vychislitel'naya Tekh. (Moscow), 1965 p 211–218
(FTD-MT-67-02; TT-67-61357; AD-649042) CFSTI: HC $3.00/MF $0.65

Possibility is considered of accelerated information exchange between memory units of a digital computer by combining in time the modes of group information transmissions from one memory unit to another and conversely. Quantitative appraisals of time gains are given as well as corresponding recommendations. Author (TAB)

N67-28260# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
BUFFER MEMORY DEVICE [BUFERNOYE ZAPOMINAYUSHCHEYE USTROYSTVO]
A. F. Gorshkov, V. M. Kirpichnikov, and M. N. Siunov 31 Jan. 1967 6 p Transl. into ENGLISH from Russian Patent No. 179095 (Appl. No. 907409/26–24, 22 Jun. 1964) 2 p
(FTD-HT-67-7; AD-649342) CFSTI: HC $3.00/MF $0.65

A buffer memory device based on ferrite cores which contains quadratic matrices with horizontal buses, vertical buses, which has the distinguishing feature that, for the purpose of simplifying the device, it contains a generator connected up to horizontal buses of a matrix, which assures their sequential sorting, generators of regulated figures connected to vertical buses, and a generator of reading connected to diagonal buses assuring their sequential sorting. Author (TAB)

N67-28264# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STORAGE DEVICE [ZAPOMINAYUSHCHEYE USTROYSTVO]
F. G. Staros, I. V. Berg et al 31 Jan. 1967 6 p Transl. into ENGLISH from Russian Patent No. 178178 (Appl. no. 940357/26-24, 25 Jan. 1965) 2 p
(FTD-HT-67-6; AD-649414) CFSTI: HC $3.00/MF $0.65

A brief description of a memory device based on multiple-orifice ferrite plates which contains number plates and the plate of a decoder, which has the distinguishing feature that, for the purpose of simplifying the manufacture and the microminiaturization of the device, the number wire made by the method of printing on the number plate is joined with the wire passing through two openings of the decoder, and the number plates together with the plate of the decoder are placed in a cassette coated with a heat reactive compound. Author (TAB)

N67-28266# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
METHOD OF ACCOMPLISHING LOGIC OPERATIONS WITH COMPLEX SETS OF SYMBOLS [SPOSOB VYPOLNENIYA LOGICHESKIKH OPERATSIY SO SLOZHNYMI KOMPLEKSAMI SIMOLOV]
L. I. Gutenmakher 31 Jan. 1967 8 p Transl. into ENGLISH from Russian Patent no. 151882 (Appl. no. 757938/26-24, 30 Dec. 1961) 3 p
(FTD-HT-67-4; AD-649413) CFSTI: HC $3.00/MF $0.65

The paper briefly describes a fast logic circuit, achieved by connecting the logic switches 'and' 'or' and 'nor', and the memory components in an n-dimensional network of a freely chosen system. The typical operations quoted are: survey and calculations of three dimensional figures, determination of the figure contours, determination of the curves created by the intersection of two different figures and similar. The diagram which is in the text shows only a simplified outline of connections, only the joints of the outer cells are illustrated. The first two memory components (n_1 and n_2) accept memorize the binary signs '1' and '0' from the similar cells of the memory circuit. The third component (n_3) accepts and memorizes the result of the logic operation from the switch (K) and passes it according to the command either to the cell of the memory circuit or to the component (n_2). The arrangement can be made four- or five-dimensional, using various magnetic, capacitive and semiconductor components. Author (TAB)

N67-28340# Stanford Research Inst., Menlo Park, Calif.
A BRIEF SURVEY OF COMPUTER LANGUAGES FOR SYMBOLIC AND ALGEBRAIC MANIPULATION Final Report
Bertram Raphael, R. G. Bobrow, L. Fein, and J. W. Young Mar. 1967 64 p refs
(Contract AF 49(638)-1752)
(AFOSR-67-0811; AD-649401) CFSTI: HC $3.00/MF $0.65

This report is a preprint of a paper summarizing a study conducted by the Comparison of Languages Subcommittee of the

ACM Special Interest Committee on Symbolic and Algebraic Manipulation (SICSAM) on 18 computer languages for symbolic and algebraic manipulation that met certain criteria of relevance and availability: ALTRAN, AMBIT, COGENT, COMIT, CONVERT, CORAL, DYSTAL, FLIP, FORMAC, FORMULA ALGOL, IPL-V, LISP1.5, LISP2, L6, PANON, SLIP, SNOBOL, and TRAC. Several other languages are also briefly discussed. For each of six groups into which the languages are classified, the paper (a) describes properties that members of the group have in common, (b) gives a brief description of each language in the group, including an excerpt from a program in the language that demonstrates the kind of problem for which the language is well suited; and (c) briefly compares the features of the languages in the group. The paper contains three appendices: (1) a reference chart that summarizes the features of all of the languages; (2) a comparison chart that emphasizes the salient distinctions between selected pairs of similar languages; and (3) a set of annotated examples of programs in various languages that solve similar problems, thus illustrating the differences in data representations, program forms, and notations. The paper is a cooperative effort of a board of consultants, including experts in each of the languages, who contributed data and reviewed the draft. TAB

N67-28376*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TEN-BIT ANALOG-TO-DIGITAL CONVERTER
Robert S. Lee Washington, NASA, Jun. 1967 10 p refs
(NASA-TN-D-3666) CFSTI: HC $3.00/MF $0.65 CSCL 09B

The electronic circuits used in a 10-bit analog-to-digital converter are described; also discussed is the method used for analog-to-digital conversion by sampling and quantizing, in which the digital counts of a data clock are measured in coincidence with a count gate of fixed width, with the input analog voltage controlling the frequency of the data clock. The accuracy achieved with basically standard logic circuits as a major feature of the method is pointed out, as well as the advantages and unusual features of the sampling method. Author

N67-28378*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
RELIABILITY MATH MODELING USING THE DIGITAL COMPUTER
Paul. O. Chelson 15 Apr. 1967 25 p ref
(Contract NAS7-100)
(NASA-CR-84790; JPL-TR-32-1089) CSCL 09B

A computer program is presented to calculate probability of system success from an arbitrary reliability block diagram utilizing the IBM 1620. It uses an algorithm that was developed using the probability tree method of calculating system success. The mechanics of the program are such that during execution it is possible to vary the probability of success as well as the arrangement of the blocks in the diagram to determine which combination has the greatest effect on the total reliability of the system. Author

N67-28393# Entelek, Inc., Newburyport, Mass.
COMPUTER-ASSISTED INSTRUCTION: A SURVEY OF THE LITERATURE Second Edition
Albert E. Hickey and John M. Newton 1 Jan. 1967 78 p refs
(Contract Nonr-4757(00))
(AD-649335) CFSTI: HC $3.00/MF $0.65

A selective review of 242 documents related to computer-assisted instruction (CAI). Principal headings: CAI Reviews and Bibliographies, Applications of CAI, Major CAI Centers, CAI Systems Studies, CAI Languages, Instructional Theory, and Program Preparation and Evaluation. An appendix lists 140 CAI programs. The review will be updated semiannually. Author (TAB)

N67-28396# RAND Corp., Santa Monica, Calif.
SOVIET CYBERNETICS: RECENT NEWS ITEMS, NUMBER 2
Wade B. Holland, ed. Mar. 1967 65 p refs
(P-3600/2; TT-67-61386; AD-649251) CFSTI: HC $3.00/MF $0.65

The problems of perfecting forms of information (its language) have paramount significance for determining efficient methods of man-machine communication. As is well known, providing such communication with existing forms of information is quite expensive: usually the savings obtained from decreasing the number of administrative personnel by using computer technology are exceeded several times by the increase in expenditures for the labor of programmers who translate natural language into machine language. Therefore, the problem of creating a single algorithmic language suitable for the peculiarities of economic information and disseminating it extensively is extremely important. No less essential are the problems of optimal coding. It is necessary to develop systems of classifiers for objects reflected in economic information: products, producers, technological methods of production, branches of industry. Without such classifiers which allow optimal coding for all necessary objects, one cannot speak of a unified and efficient information system. The creation of a unified system of economic measures and of methods for determining scientifically the precision of information is also extremely important. TAB

N67-28437# Brookhaven National Lab., Upton, N. Y.
EXPERIMENTS IN COMPUTER CONTROL AND ANALYSIS OF THE AGS
R. Frankel 1967 2 p refs Presented at the Natl. Particle Accelerator Conf., Washington, D. C.
(Contract AT(30-2)-GEN-16)
(BNL-11100; CONF-670307-7) CFSTI: HC $3.00/MF $0.65

The development, design, and test of computer input/output devices and programing techniques suitable for use in accelerator analysis and control as well as criteria for the selection of computers acceptable for analysis and control work are described. Author (NSA)

N67-28541# Mitre Corp., Bedford, Mass.
A METHOD FOR THE EVALUATION OF SOFTWARE. VOLUME II: PROCEDURAL LANGUAGE COMPILERS, PARTICULARLY COBOL AND FORTRAN
Arthur E. Budd Apr. 1967 62 p
(Contract AF 19(628)-5165)
(MTR-197, Vol. II; ESD-TR-66-113; AD-651142) CFSTI: HC $3.00/MF $0.65

This report contains procedural language compiler features considered important for comparative analysis. These features are identified in a form expressly for inclusion in the three step method for software evaluation (volume 1, AD-639 586) under category one: procedural language compilers—particularly COBOL and FORTRAN. Author (TAB)

N67-28545# System Development Corp., Santa Monica, Calif.
ONE-WAY REAL-TIME LIST-STORAGE LANGUAGES
Seymour Ginsburg and Michael A. Harrison 3 Jan. 1967 47 p refs
(Grant AF-AFOSR-1203-67)
(SDC-TM-738/029/00; SR-3; AFCRL-67-0078; AD-641064) CFSTI: HC $3.00/MF $0.65

A device is presented which has its memory organized as a list. Attention is then focused on the automaton (called an LSA) which results when the input is read one-way and the device operates in real time. The set of words (called a language) accepted by an LSA is extensively studied. In particular, several characteristics and closure properties of languages are given. Author (TAB)

N67-28570# Wisconsin Univ., Madison. Dept. of Statistics.
TRANSFORMATIONS: SOME EXAMPLES REVISITED
Norman R. Draper and William G. Hunter Dec. 1966 29 p refs
(Contract Nonr-1202(17))
(TR-100; AD-649593) CFSTI: HC$3.00/MF$0.65

Modern computing equipment is extremely fast and can also provide graphical output. Prior to the computer era, problems were often formulated in terms of a single numerical criterion which could be handled conveniently on a desk calculator. Now several aspects of a problem or several criteria can be considered simultaneously and a more flexible attitude adopted. The situation then can often be easily understood by the experimenter, and compromise decisions can be made by him. In this paper we consider the particular problem of transforming data from this viewpoint by re-examining some specific published examples. TAB

N67-28653*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DATA HANDLING AND PROCESSING
In its Res. and Advanced Develop., Vol. II 31 Jan. 1967 p 263–280 refs (See N67-28641 15-34)

Optical support equipment for data handling and spacecraft testing techniques are considered for advanced spacecraft technology. Circuit testing techniques being evaluated include voltage margin testing, RF noise spectra measurements, and infrared scanning measurements. Digital video processing is under investigation, as is an advanced digital bulk memory system. Tape recorder component studies, video data retrieval, and solid state memory storage are described. M.W.R.

N67-28703# Reactor Centrum Nederland, Petten
AN ALGOL PROCEDURE FOR THE SOLUTION OF LEAST SQUARES PROBLEMS WITH CONSTRAINTS
H. M. Rietveld Mar. 1967 19 p refs
(RCN-67) CFSTI: HC$3.00/MF$0.65

A description is given of a general Algol procedure to solve least squares problems with constraints on the parameters. The procedure is particularly applicable to the case where either the observational equations or the constraints, or both, are non-linear in the parameters. Author (ESRO)

N67-28719# Little (Arthur D.), Inc., Cambridge, Mass.
PAPERS ON AUTOMATIC LANGUAGE PROCESSING. VOLUME I: SELECTED COLLECTION STATISTICS AND DATA ANALYSES Technical Report, Jan. 1965–Dec. 1966
Paul E. Jones, Vincent E. Giuliano, and Robert M. Curtice Bedford, Mass., AFSC, Electron. Systems Div., Feb. 1967 122 p refs
(Contract AF 19(628)-3311)
(ESD-TR-67-202, Vol. I; AD-649073) CFSTI: HC $3.00/MF $0.65

As part of a research program aimed at determining the parameters influencing the effectiveness of a message retrieval system, a collection of 10,000 technical abstracts was indexed and retrieval experiments were conducted with them. Since part of the work involved the development and test operation of an associative retrieval system, basic data about the distribution of words and word strings were gathered in preparing the system for test and trial. These statistics were thought to be of possible interest to other workers in the field and are gathered as a series of loosely connected papers in this volume under the following groupings: Characteristics and Indexing of GE Data Base; Comparison of Manual and Machine Selected Vocabularies; Vocabulary Distribution Studies, and Studies of Content Bearing Units in Text. Author (TAB)

N67-28765*# International Business Machines Corp., Gaithersburg, Md. Scientific Satellite Systems Dept.
SPACE SYSTEMS ANALYSIS AND COMPUTER PROGRAMMING SERVICES Quarterly Progress Report, 1 Jan.–31 Mar. 1967
31 Mar. 1967 195 p refs
(Contract NAS5-10022)
(NASA-CR-84797; QPR-3) CFSTI: HC $3.00/MF $0.65 CSCL 09B

Details are presented on the ground support systems in the areas of satellite attitude determination and steering, orbit determination, maneuver command, telemetry data processing and reduction, operations support, and business management controls. Special mention is made of the support given to the launch and subsequent mission of TIROS Operations Satellite-B, Orbiting Solar Observatory-C, and Applications Technology Satellite-A. In-orbit support of other than routine nature is described for Atmospheric Explorer-B and Applications Technology Satellite-B. Definitive orbit work was performed on the ATS-B, GEOS, and POGO satellites. Detailed recommendations and conclusions are included. N.E.N.

N67-28782# Library of Congress, Washington, D. C. Aerospace Technology Div.
COMPUTER TECHNOLOGY Surveys of Foreign Scientific and Technical Literature
Boris Doncov 4 Apr. 1967 37 p refs
(ATD-67-19)

Abstracts were selected from Soviet open-source literature. Information not directly related to the assigned subject has been included because of its broad implications for study in this field. The abstracts are arranged alphabetically by author within each of the following categories: components, design, applications, and associated systems. A bibliography is presented at the end of the report. Author

N67-28894# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MEMORY UNIT [ZAPOMINAYUSHCHEYE USTROYSTVO]
M. S. Lyubchanskiy 31 Jan. 1967 6 p Transl. into ENGLISH from Russian Patent no. 178167 (Appl. no. 912749/26-24, 20 Jul. 1964) 2 p
(FTD-HT-67-5; AD-649341) CFSTI: HC$3.00/MF$0.65

A memory device containing matrices of magnetic multiple-orifice elements with interrogation windings passed through some of the openings of the elements, output windings passed through other openings of the elements, and bias windings passed through the same openings as the interrogation windings which has the distinguishing feature that, for the purpose of simplifying the scheme of control of the device in each matrix divided in two, the windings of interrogation are passed through in one half in accordance with the bias winding, and in the other in the opposite direction. Author (TAB)

N67-28909# Stanford Univ., Calif. Computer Science Dept.
FLOATING-POINT NUMBER REPRESENTATIONS: BASE CHOICE VERSUS EXPONENT RANGE
Paul Richman 28 Apr. 1967 38 p refs
(Contract Nonr-255(37))
(CS-64; AD-651201) CFSTI: HC$3.00/MF$0.65

A digital computer whose memory words are composed of r-state devices is considered. The choice of the base, beta, for the internal floating-point numbers on such a computer is discussed. Larger values of beta necessitate the use of more r-state devices for the mantissa, in order to preserve some minimum accuracy, leaving fewer r-state devices for the exponent of beta. As beta increases, the exponent range may increase for a short period, but it must ultimately decrease to zero. Of course, this behavior depends on what definition of accuracy is used. This behavior is analyzed for a recently proposed definition of accuracy which specifies when it is to be said that the set of q-digit base beta floating-point numbers is accurate to p-digits base t. The only case of practical importance today is t = 10 and r = 2; and in this case beta = 2 is always best. However, the analysis is done to cover all cases. Author (TAB)

N67-28911# Electronic Systems Div., Bedford, Mass.
A SYSTEMS APPROACH TO COMPUTER PROGRAMS
Joseph L. Pokorney and Wallace E. Mitchell Feb. 1967 24 p refs
(ESD-TR-67-205; AD-650216) CFSTI: HC $3.00/MF $0.65

Recent experience at ESD in acquiring complex computer based systems has identified a deficiency in existing systems management techniques in the area of computer programs. The systems management techniques generally in use were designed for equipment systems and need to be expanded to include computer programs. This paper describes an ESD approach to adapting existing AFSC system management techniques to computer programs. Procedures for insuring system compatibility, design integrity and technical control are discussed and a method for achieving design verification and qualification is presented. Particular emphasis is placed on the relationship of these techniques to computer programs as elements of large computer based systems. The application of these techniques is illustrated through selected examples taken from current ESD system procurements. TAB

N67-28956# Northwestern Univ., Evanston, Ill. Technological Inst.
SOLUTION THEOREMS IN PROBABILISTIC PROGRAMMING: A LINEAR PROGRAMMING APPROACH
Abraham Charnes, Michael J. L. Kirby (Dalhousie Univ.), and William M. Raike (Texas Univ.) Mar. 1967 28 p refs *Its* Systems Res. Memo No. 174
(Contracts Nonr-1228(10); DA-31-124-ARO-D-322)
(AD-650284) CFSTI: HC $3.00/MF $0.65

For some years research on solution theorems in probabilistic programming has been dormant. The obvious consequences of formal similarities to deterministic mathematical programming problems had been rapidly exhausted by researchers. Currently, however, the deeper study which was taking place during the dormant period has begun to produce results. On the one hand theorems characterizing optimal classes of stochastic decision rules for various general change-constrained problems have been obtained. On the other hand, a great amount of effort has been expended on the special class of problems called linear programming problems under uncertainty, usually 2-stage and under still more special assumptions. The general objective of these specializations has been to attain results and thereby to gain insight and technique to reapproach more fruitfully the more important and general but more recondite probabilistic programming problems. To this end, few abstractions or devices, from finite-dimensional Banach spaces to the Kakutani fixed-point theorem appear to have gone untried, except, perhaps, the ancient one of study and correlation of the existent results of other researchers. It is the purpose of this paper to provide some such correlation and a redirection so that these simpler probabilistic programming problems may be overcome in all generality with new, simpler methods which offer some promise of extension to the more involved chance constrained (and other probabilistic) models. TAB

N67-28963# RAND Corp., Santa Monica, Calif.
KEEPING THE UPPER HAND IN THE MAN–COMPUTER PARTNERSHIP
Barry W. Boehm Apr. 1967 28 p refs
(P-3533; AD-650371) CFSTI: HC $3.00/MF $0.65

Contents: Augmenting creativity; Computer characteristics; Artificial intelligence; The AIAA computer subcommittee; Hardware trends; Large-scale integrated circuits (LSI's); Hardware performance; Computer organization trends; Man-Computer partnership On-Board; The on-board information explosion; Real time operations; Conversational computing; On-line systems and computer graphics; Implementation problems; Changing one's problem-solving methodology; The computer downstairs; Diversity and change; New directions; Social implications; Numerical analysis; Software; Systems analysis; Procrustean computer system; Maintaining relevance; Creativity aided, not replaced. TAB

09 ELECTRONIC EQUIPMENT

Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

N67-27796# Royal Aircraft Establishment, Farnborough (England).
EXPERIMENTAL INVESTIGATIONS OF TWO-DIMENSIONAL APERTURE CORRECTION OF TELEVISION CAMERA TUBES USING A VIDICON STORAGE UNIT [EXPERIMENTELLE UNTERSUCHUNGEN ZUR ZWEIDIMENSIONALEN APERTURICORREKTUR VON FERNSEHAUFNAHMEROHREN MIT EINEM VIDIKONSPEICHER]
Ferdinand Arp Jan. 1967 36 p refs Transl. into ENGLISH from German
(RAE-LIB-TRANS-1204) CFSTI: HC $3.00/MF $0.65

Descriptions are given of attempts to realize the two-dimensional correction of the aperture diaphragm of camera tubes with consideration of signal cross-talk also from the closely adjacent lines of the picture. Since the immediately adjacent lines are always in the alternate field of the signal, the video signal to be equalized must be stored for about the duration of a field. The well-known storage methods are reviewed with respect to the coincidence accuracy of related picture elements. Electrostatic storage of the signal calls for the lowest amount of complexity. A storage arrangement with two vidocon tubes is described where, alternating at the picture pulse rate, one tube at a time is used for information storage, while the stored signal is being read out of the other. The continuous sequence of stored signals is thus available at the output. On the basis of operating experience, a storage unit with a single vidicon tube was developed; the signal can be continuously read into and withdrawn from this tube. Results are reported and the usefulness of the storage unit for the electrical elimination of the undesired storage action over long periods in vidicon camera tubes is discussed. Author

N67-27822 Joint Publications Research Service, Washington, D. C.
CONCERNING THE DYNAMICS OF JOINT OPERATION OF TRANSISTORS WITH TUNNEL DIODES
A. K. Azov *In its* Izv. VUZov: Instr. Bldg., Vol. 9, No. 6 27 Mar. 1967 p 1–4 refs (See N67-27821 15-14)

Under consideration is a particular case of transistors connected with pulse-circuits containing tunnel diodes. The derived analytical and graphical relationships make it possible to determine the minimum capacitances of the intermediate capacitor; also shown are the data obtained by checking experimentally. Author

N67-27823 Joint Publications Research Service, Washington, D. C.
CONCERNING THE OPTIMUM CONDITIONS FOR GENERATING DEVICES WITH AUTOPARAMETRIC FREQUENCY MULTIPLICATION IN ULTRASONIC RANGE
K. Yu. Agranovskiy and O. G. Antonov *In its* Izv. VUZov: Instr. Bldg., Vol. 9, No. 6 27 Mar. 1967 p 5–9 refs (See N67-27821 15-14)

Consideration is given to the engineering design of generating devices with nonlinear inductances and with autoparametric frequency multiplication that can be used in the range of ultrasonic frequencies. Author

N67-27825 Joint Publications Research Service, Washington, D. C.
CERTAIN DESIGN-FEATURES OF ZERO-LEVEL DRIFT OF TRANSISTOR D-C AMPLIFIERS

V. I. Anisimov *In its* Izv. VUZov: Instr. Bldg., Vol. 9, No. 6 27 Mar. 1967 p 14–17 (See N67-27821 15-14)

It is shown that, in a general case, the zero-level drift of transistorized dc amplifiers has three components. General expressions are given for calculating these components. Author

N67-27831 Joint Publications Research Service, Washington, D. C.

CONCERNING THE CIRCUIT-DESIGN OF FLAT MEASURING WINDINGS OF TRANSFORMER-TYPE OF FUNCTIONAL CONVERTERS

L. F. Kulikovskiy, N. Ye. Konyukhov, and L. A. Brovkin *In its* Izv. VUZov: Instr. Bldg., Vol. 9, No. 6 27 Mar. 1967 p 39–44 refs (See N67-27821 15-14)

Analytical and graphic–analytical methods of designing the functional windings of contactless functional converters are examined. The bulging of the movable element of converters are both considered in, and eliminated from, the analyses. Author

N67-27833 Joint Publications Research Service, Washington, D. C.

SWITCHING TIME AND POWER LOST BY COMPOUND TRANSISTORS OPERATING UNDER COMMUTATING CONDITIONS

T. N. Yakhnina *In its* Izv. VUZov: Instr. Bldg., Vol. 9, No. 6 27 Mar. 1967 p 50–54 refs (See N67-27821 15-14)

An analytical method of calculating the switching time and the power lost by compound transistors is described. Theoretical and experimentally obtained curves are presented for switching time, and recommendations are given for selecting the input signals of compound transistors. Author

N67-27835 Joint Publications Research Service, Washington, D. C.

PHOTOELECTRIC TRANSDUCERS AS CONTROLLED ELEMENTS OF ELECTRIC CIRCUITS

M. S. Roytman, E. I. Tsimbalist, and A. I. Lysov *In its* Izv. VUZov: Instr. Bldg., Vol. 9, No. 6 27 Mar. 1967 p 60–64 refs (See N67-27821 15-14)

Under consideration are the characteristics of controlled elements based on photoresistors and low-power incandescent lamps. Author

N67-27838 Joint Publications Research Service, Washington, D. C.

DIGITAL SMOOTHING FILTERS WITH HIGH ORDER OF ASTATICISM

A. I. Bobikov, M. N. Grigoryev, and Yu. M. Korshunov *In its* Izv. VUZov: Instr. Bldg., Vol. 9, No. 6 27 Mar. 1967 p 72–74b refs (See N67-27821 15-14)

A method is described for designing digital smoothing filters with high order of astaticism as a combination of known filters with astaticism of the first order. Block-diagrams of similar filters and expressions are given for determining the principal parameters of filters with astaticism of second and third orders. Author

N67-27987# Army Electronics Lab., Fort Monmouth, N. J. Electronic Components Lab.

A NEW MICROWAVE SEMICONDUCTOR OSCILLATOR

V. J. Higgins, F. A. Brand, and J. J. Baranowski *In* Army Dept. Proc. of the 1966 Army Sci. Conf., Vol. I 26 Aug. 1966 p 453–467 refs (See N67-27941 15-34) (AD-634689)

Expitaxial GaAs varactor diodes with low junction capacitance and with series resistance were obtained which display CW outputs of more than 25 mW with over 5% efficiency in the 13 GHz range. Tunability was demonstrated with oscillation bandwidths of 6 to 10% recorded in both X and KU bands; and CW oscillations of more than 0.5 mW observed at 30 GHz. Pulsed and CW oscillations were also observed with silicon p-n junction avalanche oscillators, but these display rf output and efficiencies less than that of the GaAs units. Careful diode packaging procedures are stressed to insure efficient operation in these avalanche devices, which are considered particularly applicable where the noise figure is not a paramount requirement and where gain is required at input levels above −10 dbm. M.W.R.

N67-27987# Army Electronics Labs., Fort Monmouth, N. J.

TRANSMISSION MODE uhf MAGNETO-ACOUSTIC DELAY LINE

William Skudera, Robert Sproat, Isidore Bady, and Emanuel Gikow *In* Army Dept. Proc. of the 1966 Army Sci. Conf., Vol. II 26 Aug. 1966 p 325–338 refs (See N67-27971 15-34) (AD-634640)

Experimental and theoretical studies are reported on a magnetoacoustic delay line, in which both spin waves and acoustic waves are utilized. A single crystal YIG rod with optically polished end faces served as the transducer and the delay medium in an external magnetic field supplied by an electromagnet positioned parallel to the rod axis. Delay measurements as functions of externally applied fields of several frequencies showed a decrease with biasing field increase up to a limiting level of 3.2 microseconds. Slow and fast insertion losses covered the frequency range of 200 to 1,000 mc; fast variation effects were attributed to mismatch reflection at the turning point between the main and secondary pulses. The use of auxiliary magnets reduced insertion losses and eliminated fast pulse variations. G.G.

N67-28119 Joint Publications Research Service, Washington, D. C.

REALIZATION OF POWER FUNCTIONAL RELATIONSHIPS ON NONLINEAR SEMICONDUCTOR RESISTORS

V. M. Chukhontsev *In its* Izv. VUZov: Instr. Bldg., Vol. 9, No. 2 23 Feb. 1967 p 90–93 refs (See N67-28101 15-14)

Consideration is given to problems of designing functional converters based on nonlinear semi-conductor resistors for reproducing power relationships. Author

N67-28121 Joint Publications Research Service, Washington, D. C.

HIGH SPEED SHIFT REGISTER ON TUNNEL EFFECT DIODES

A. S. Mkrtchyan *In its* Izv. VUZov: Instr. Bldg., Vol. 9, No. 2 23 Feb. 1967 p 101–103 (See N67-28101 15-14)

Details are given on a tunnel diode shift register. Emitter followers are used in the arrangement to eliminate reverse information flow. The design is simple in operation and functions reliably at an initiating pulse frequency up to several tens of megacycles. Author

N67-28193# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

BIAX MAGNETIC LOGICAL ELEMENT [MAGNITNYY LOGICHESKIY ELEMENT NA BLAKSE]

V. I. Kuznetsov and G. M. Ofitserov 31 Jan. 1967 6 p Transl. into ENGLISH from Russian Patent No. 179088 (Appl. No. 876150/26-24, 15 Jan. 1964) 2 p (FTD-HT-67-11; AD-649415) CFSTI: HC $3.00/MF $0.65

A magnetic logic element based on biax, which contains two input windings, output windings, and a gate winding, which has the distinguishing feature that for the purpose of effecting the logic function prohibition and nor, the input windings are located in both apertures of the biax with identical direction in one of the apertures of the biax and opposite in the other. Author (TAB)

N67-28194# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SHIFT REGISTER [REGISTR SDVIGA]
V. P. Khvedynich and P. N. Polikarpov 31 Jan. 1967 7 p Transl. into ENGLISH from Russian Patent No. 176720 (Appl. No. 910097/26-24, 8 Jul. 1964) 2 p
(FTD-HT-67-12; AD-649416) CFSTI: HC $3.00/MF $0.65

A shift register based on magnetic cores which has the distinguishing feature that for the purpose of increasing the rapidity of its working, expansion of the temperature operating range, and widening of the tolerances for change in the parameters of the pulses of the feed currents each primary element of the register contains two memory cores having on one core a feed (movement) winding and an input winding that are counter to each other, the other core being the standardizing one with a shift winding joined by a loop of connection with the memory cores. Author (TAB)

N67-28203# Lyon Univ. (France). Faculte des Sciences.
STUDIES OF THE STATISTICAL PROPERTIES OF THE MULTIPLIER STRUCTURE OF A PHOTOMULTIPLIER [ETUDE DES PROPRIETES STATISTIQUES DE LA STRUCTURE MULTIPLICATRICE D'UN PHOTOMULTIPLICATEUR]
Richard Bouche 24 Feb. 1965 87 p refs In FRENCH
(NP-16546)

After a review of the studies made on various resolutions for photomultipliers, the calculation of the time resolution is attempted by making an approach to a statistical study of the photomultiplier. The energy resolution is first calculated. For the time resolution an analysis of the action of different parts of the photomultiplier with respect to the time variable shows that it is impossible to use classical procedures. Therefore it is proposed to use the Monte Carlo method to calculate the percussional response of the photomultiplier. This consists of computer simulation of the operation of the photomultiplier. This method of calculation is described and it is shown how it is possible to generate statistical distributions in a computer and how such generations make it possible to simulate random phenomena. An attempt is then made to define a statistical model of the photomultiplier beginning with known experimental results making it possible to define the simulation programs. Two simulation procedures are then studied: a very simple model of the photomultiplier and a more realistic model of the photomultiplier. The results show that the study is much more profitable in the case of a simple multiplying structure than in the case of the complex model. NSA

N67-28251# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
METHOD FOR FABRICATING HIGH RESISTANCE FILM RESISTORS [SPOSOB IZGOTOVLENIYA VYSOKOOMNYKH PLENOCHNYKH SOPROTIVLENIY]
B. A. Bochkarev 23 Jan. 1967 6 p Transl. into ENGLISH from Russian Patent No. 173828 (Appl. No. 885297/26-9, 21 Feb. 1964) 2 p
(FTD-HT-66-702; AD-649405) CFSTI: HC $3.00/MF $0.65

The paper presents a method for fabricating high resistance film resistors, based on the vacuum sublimation of a high resistance alloy and a dielectric. To simplify the automation of the resistor fabrication process, the high resistance wire in glass insulation is subjected to sublimation. The wire is interwoven into a tungsten wire plait which serves as the heater. Author (TAB)

N67-28386# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CONTROLLABLE p-n-p-n SWITCHES
V. I. Grinshteyn and V. M. Shevtsov 23 Dec. 1966 23 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Elektromekhan. (Novocherkassk), no. 2, 1964 p 259–269
(FTD-HT-66-369; TT-67-61335; AD-649036) CFSTI: HC $3.00/MF $0.65

An elementary description and Soviet-type characteristics of pnpn diodes and pnpn controlled rectifiers are given. The Soviet-make silicon power diodes and rectifiers are manufactured for 10-150 amp, 50-1,000 v. A turn-on current within 2-15 ma was measured in controlled rectifiers of 10-20 amp rated current. Switching voltages at +25, +75, and -60C are reported. A few possible applications are listed. Author (TAB)

N67-28389# Radio Corp. of America, Princeton, N. J.
PRELIMINARY DEVELOPMENT OF A SOLID-STATE MATRIX DISPLAY Technical Report, 1 Apr. 1964–30 Apr. 1965
Bernard J. Lechner Wright-Patterson AFB, Ohio, AF Flight Dyn. Lab., Jan. 1967 168 p refs
(Contract AF 33(615)-1493)
(AFFDL-TR-66-5; AD-649553) CFSTI: HC $3.00/MF $0.65

The use of ferroelectric transchargers as storage and control elements in an electroluminescent matrix display is reported. Research on display panel circuitry led to control circuits useful for solid-state matrix display. In these circuits, ferroelectric elements provide analog storage and control energization of electroluminescent cells in accordance with stored analog signals. The ferroelectric, in conjunction with a diode, provides a selection threshold which permits the element to be addressed in a matrix by voltage coincidence. The new circuits give greatly improved brightness and contrast compared with previous ferroelectric control circuits. Transcharger circuits with logic capability have also been developed; such circuits are especially useful for bar graph, moving pointer, and similar displays. Three experimental model displays demonstrated brightness as high as 48 ft-L; contrast ratio in excess of 100:1; geometric resolution as great as 10-elements per in.; capability for producing a gray scale; and a frame rate which allows continuity of motion without blurring or flicker. The performance of these models demonstrates the potential of using ferroelectric control circuits and electroluminescent elements for high-brightness, high-resolution, all solid-state matrix displays. Author (TAB)

N67-28394# Amperex Electronic Corp., Hicksville, N. Y.
NON-INTERCEPTING GRID STUDY—TUBE TYPE DX-321 Final Report, 30 Nov. 1965–1 Jun. 1966
E. G. Dorgelo and H. R. Parnagian Griffiss AFB, N. Y., RADC, Jan. 1967 116 p
(Contract AF 30(602)-3969)
(RADC-TR-66-695; AD-649316) CFSTI: HC $3.00/MF $0.65

The non-intercepting grid design studied in this program was the field effect tube where the grid (or gate) is essentially a frame through which the emitted electrons are directed, by a parallel magnetic field, on to the anode. Electron transit time was investigated for its effect on UHF applications of the tube. Trade-offs between power and maximum frequency were found to result in electrode structures and spacings of very small size at UHF. This requires very high current densities. 40 amperes per square centimeter were employed to experimentally produce 12 KW output at 300 mc peak with 20% efficiency. For use at UHF additional recommendations include grounded grid (gate) circuit, coaxial construction, use as an amplifier, or an oscillator with feedback independently adjustable both in phase and magnitude. Author (TAB)

N67-28407# California Univ., Livermore. Lawrence Radiation Lab.
A HIGH-VOLTAGE PULSE, REFLECTION-TYPE "FANOUT" ATTENUATOR WITH SUBNANOSECOND RESPONSE
Robert J. Thomas 10 Oct. 1966 41 p refs
(Contract W-7405-ENG-48)
(UCRL-14723) CFSTI: HC $3.00/MF $0.65

Subnanosecond response (as low as 0.1 nanosecond) was achieved for a high-voltage pulse attenuator based on the principle of traveling wave reflection at an abrupt reduction in impedance

level at a specific boundary along a transmission line. It allows practically distortionless attenuation of the signal, independent of voltage level. The impedance mismatch in this particular design is effected by a fanout of multiple output cables fed from a single input cable. The fanout junction, or header design, is critical in affecting rise-time response. This attenuator configuration is especially suited for use in a measurement system to attain high resolution of fast-changing, wide dynamic range, high voltage signals. Author (NSA)

N67-28408# Ceskoslovenska Akademie Ved, Rez. Ustav Jaderneho Vyzkumu.

THE APPLICATION OF TUNNEL DIODES IN FAST ELECTRONIC CIRCUITS FOR NUCLEAR PHYSICS [APLIKACE TUNELOVYCH DIOD V RYCHLYCH OBVODECH ELEKTRONIKY PRO JADERNOU FYZIKU]

D. Blaho 1966 17 p refs In CZECHOSLOVAKIAN; ENGLISH summary
(UJV-1675)

Some of the most important applications of tunnel diodes in fast electronic circuits used for nuclear physics are reported. These are amplitude integral and differential discriminators, shaping circuits, binary and decade scalers, coincidence circuits, and analog-to-digital converters. Author (NSA)

N67-28444# Tennessee Univ., Knoxville. Dept. of Electrical Engineering.

A WIDEBAND, LINEAR, TRANSISTORIZED CABLE DRIVER

J. G. Barrett and T. V. Blalock 12 Dec. 1966 89 p refs Prepared for Oak Ridge Natl. Lab.
(Contract W-7405-ENG-26)
(SR-22; TID-23671) CFSTI: HC $3.00/MF $0.65

A theoretical analysis and an experimental verification of a transistor, wideband, linear cable driver having a complementary emitter-follower output stage which is included in an overall series feedback loop are reported. The analysis is concerned with bandwidth, gain stability, drive capability, input impedance, and output impedance. The complementary emitter-follower output stage is analyzed for two quasi-linear modes of operation. The resistive and capacitive contributions of the first stage hybrid-pi parameters to the input impedance are found separately. The effects of an active, dc feedback loop on the stability of the quiescent operating levels, the low-frequency performance, and the output dc voltage are investigated. Experimental results are in excellent agreement with derived quantities. The driver is capable of driving ± 2 volts linearly across 93 ohms with a 19 nanosecond 10 to 90 percent rise-time. The input capacitance does not exceed 4 pf. The input resistance becomes negative at frequencies exceeding 35 MHz. The output impedance is low and resistive for frequencies less than 500 KHz. For frequencies greater than 500 KHz, the output impedance becomes increasingly inductive. The rate of change of voltage gain with respect to ambient temperature is 20 parts per million per degree centigrade at room temperature (25°C). Author (NSA)

N67-28445# Tennessee Univ., Knoxville. Dept. of Electrical Engineering.

A LOW-NOISE, HIGH INPUT IMPEDANCE PULSE AMPLIFIER

W. H. Bailey and T. V. Blalock 27 Dec. 1966 112 p refs Prepared for Oak Ridge Natl. Lab.
(Contract W-7405-ENG-26)
(SR-23; TID-23670) CFSTI: HC $3.00/MF $0.65

A simple two-stage voltage-sensitive amplifier with high input impedance was designed, constructed and evaluated for use as a wideband low-noise pulse preamplifier. The amplifier configuration is a common source field-effect transistor input stage feeding a common-emitter bipolar transistor output stage. The two stages are enclosed by an overall series-feedback loop. The theoretical characteristics of the amplifier were determined by both digital computer and simplified equivalent circuit analyses and then verified by experimental measurements. The voltage transfer function and input impedance were determined as functions of frequency and transistor bias currents. A negative input resistance region was given special attention. The contributions of all important noise generators to the midband equivalent noise voltage (ENV) were obtained as functions of bias currents. The experimental amplifier had a voltage gain of 5, a bandwidth of 50 MHz, and an ENV of 5 nv./(Hz.)$^{1/2}$. Author (NSA)

N67-28486# Oak Ridge National Lab., Tenn.

NEW TECHNIQUE FOR REMOVING CHARGE FROM THE STORAGE CAPACITOR IN DIRECT CURRENT ANALOG-TO-PULSE-RATE CONVERTERS

F. M. Glass 23 Feb. 1967 14 p refs
(Contract W-7405-ENG-26)
(ORNL-TM-1765) CFSTI: HC $3.00/MF $0.65

A new all solid-state direct-current integrator integrates currents as low as 10^{-11} amp with an accuracy of 1%. Currents as low as 10^{-12} amp can be integrated with approximately the same accuracy when fast response is not a necessity. This integrator features solid-state current switches that have sufficient speed for single-range, recycling ionization detectors to cover four decades. These switches are complementary silicon planar transistors that operate in the inverted-mode with both their base-emitter and base-collector junctions reverse biased. The individual leakage currents in the quiescent state total about 10^{-13} amp. When matched complementary pairs are used, the algebraic sum of the leakage current can be less than 10^{-14} amp. Recycling rates of 20 kHz are easily obtainable. Author (NSA)

N67-28494# Central Lab. for Radiological Protection, Warsaw (Poland).

THE CHARGE-SENSITIVE PREAMPLIFIER AND LINEAR PULSE AMPLIFIER FOR SEMICONDUCTOR DETECTORS

St. Glowacki 1966 15 p refs In POLISH; ENGLISH summary
(CLOR-60/D)

A charge sensitive preamplifier and linear pulse amplifier with resolution of 3.5 keV fwhm are described. The output signal level is 8 V for 200 keV of beta particle energy lost in a silicon detector. The expander of gain of 10 V/V in the amplifier is provided, owing to the fact that the accuracy of measurement is magnified. The amplifier is developed for direct driving of the pulse-to-time converter of a multichannel analyzer. Author (NSA)

N67-28500# Polish Academy of Sciences, Warsaw. Inst. of Nuclear Research.

TIMING SINGLE CHANNEL PULSE HEIGHT ANALYZER

M. Nadachowski Nov. 1966 14 p refs
(INR-763/III/E)

A transistorized single channel pulse height analyzer with a fixed delay of the output pulse is described. The delay may be adjusted from 0.5 to 1 μsec. The amplitude range of the analyzer is 200 mV–10 V. The block diagram, some circuit details and characteristics of the analyzer are given. Author (NSA)

N67-28534# Los Alamos Scientific Lab., N. Mex.

CROSSING HIGH-VOLTAGE INTERFACES WITH LARGE BANDWIDTH SIGNALS

Rudolf P. Severns, Thomas F. Turner, and Alfred R. Koelle [1967] 14 p Presented at Natl. Particle Accelerator Conf., Washington, D. C.
(Contract W-7405-ENG-36)
(LA-DC-8370; CONF-670307-20) CFSTI: HC $3.00/MF $0.65

In connection with a 50-kV modulator development, three methods of crossing the high-voltage interfaces at a 1-MHz bandwidth are being developed. The first system uses a pulse

transformer driven from ground by solid-state electronics. The second system is an amplitude-modulated rf carrier operating at 5 MHz. The third method uses a Hewlett–Packard HPA-4309 electro-optical isolator with solid-state amplifier on the high-voltage side. A description is given of experiment and results with each method.
NSA

N67-28612# Advanced Kinetics, Inc., Costa Mesa, Calif.
INDUCTIVE STORAGE SWITCH STUDY Final Report, Sep. 1965–Sep. 1966
R. W. Waniek, H. P. Furth, and D. M. Fitzgerald Griffiss AFB, N. Y., RADC, Feb. 1967 112 p refs
(Contract AF 30(602)-3512)
(RADC-TR-66-774; AD-650731) CFSTI: HC $3.00/MF $0.65

The problems encountered when discharging an inductive storage device into a load are discussed in detail. Experiments with a switch using a liquid metal to solid metal contact resulted in electrode erosion which could not be prevented. This led to the exclusive use of liquid electrodes which are self healing. A variety of switch configurations were devised and tested including two types of vertical flow interrupters. Data from these tests which were conducted with both mercury and liquid sodium as the switching medium is presented.
Author (TAB)

N67-28624# Army Electronics Labs., Fort Monmouth, N. J.
THEORY OF OHMIC CONTACTS
Jueri Vilms and Lothar Wandinger Feb. 1967 19 p refs
(ECOM-2800; AD-650738) CFSTI: HC $3.00/MF $0.65

Contact resistivity of a metal-semiconductor area contact is calculated for 10 to the 18th power - 10 to the 20th power/cu cm doping range, for n-type semiconductors and 0.7 - 1.0 eV barrier heights employing a thermionic-field emission model with neglect of barrier width fluctuation. Application to design of ohmic contact to group IV and III-V semiconductors is indicated. A criterion for an electrically good ohmic contact is proposed and the frequently encountered patchiness problem in practical alloy-contact work is discussed.
Author (TAB)

N67-28637# City Coll. Research Foundation, New York.
ELECTROSTATIC FOCUSING OF HOLLOW SPIRALING ELECTRON BEAMS Final Technical Report, 5 Jan. 1965–5 Nov. 1966
M. Ettenberg Mar. 1967 94 p
(Contract DA-28-043-AMC-00466(E))
(ECOM-00466-F; AD-650577) CFSTI: HC $3.00/MF $0.65

A number of experimental models of a radial injection cathode for electrostatic focusing were built and tested. The most successful of these models gave a transmission efficiency of about 70% at low perveances. The highest perveance model gave a maximum of 30% transmission. A theoretical description has been developed for the focusing of a hollow spiraling electron beam which indicates the limits on this technique. It also gives design information on injection requirements. A computer study was made of the potential in the injection region in the absence of space charge. A computer study was also made of beam trajectories in the electrostatic focusing region under a variety of injection conditions. A computer study was begun of a simplified cathode injection area including the motion of emitted electrons and space charge effects.
Author (TAB)

N67-28655*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ELECTRONICS TECHNIQUES AND COMPONENTS
In its Res. and Advanced Develop., Vol. II 31 Jan. 1967 p 309–330 refs (See N67-28641 15-34)

Degradation and failure modes in multifunctioning semiconductor devices are under investigation to improve device reliability. Spacecraft electronic packaging and cabling concepts and related technological studies are reported, including improvement of electronic circuit interconnect reliability and development of nonmagnetic interconnect welding materials. Researches are also concerned with microelectronic packaging, the application of monolithic and thin film integrated circuit technology to the synthesis of advanced planetary spacecraft telemetry, command, and data storage subsystems; and in-flight failure rates of spacecraft electronic parts.
M.W.R.

N67-28661*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ELECTRO PHYSICS RESEARCH
In its Res. and Advanced Develop., Vol. II 31 Jan. 1967 p 487–537 refs (See N67-28641 15-34)

Research studies dealing with many branches of physics are reported in this section. Charge transport theories, an electron gun and a magnetic diode are investigated under thermionics studies; excited atomic oxygen and reactions of ground state oxygen are the photochemical researches; and plasma physics research deals with hyperbolic neutral line phenomena. Gas-solid interactions are being investigated by the radiation chemistry group, the Dynamitron accelerator and natural source fission fragment experiments by the nuclear physicists; and electro-optic crystals, evaporated cadmium sulfide photodetectors, and thin film barriers are the optical physics studies. Film superconductors, refrigeration, sound propagation in liquid helium are reported under cryogenics research; nuclear magnetic resonance and DeHaas–van Alphen studies under cryogenics; and magnetic interactions and MnBi thin films under magnetics. Semiconductor studies deal with space charge limited current in germanium and titanium oxide thin films; theoretical physics studies with quantum theory of radiation and matter, plasma and many-body theory, relativity and gravitation, and fundamental particles.
M.W.R.

N67-28679* Ion Physics Corp., Burlington, Mass.
AN ELECTROLYTIC DAMPING RESISTOR FOR THE MICRO-PARTICLE ACCELERATOR Final Report
May 1967 10 p refs
(Contract NAS2-3757)
(NASA-CR-73089) CFSTI: $3.00 CSCL 09A

A damping resistor of the electrolytic type employing copper sulphate solution was designed and tested in the microparticle accelerator generator-switch assembly. An assembly drawing of the resistor is included. Additional data are presented on the use of electrolytic resistors in plasma physics research. Information gained partly from their use in service and partly from brief laboratory tests include electrical resistance, energy and current ratings, electrodes, and effect of air bubbles in the solution. The electrolytic resistor offers the principal advantage of high-energy absorption with flexibility in the choice of resistor value over a wide range. The principal disadvantage is that there is a liquid to be contained and occasionally topped up. On direct current, for one filling of electrolyte, the resistors have a limited though long life depending on duty. Eventually the solution is deprived of copper ions. On pulsed or alternating currents no limits were found.
S.P.

N67-28716# Illinois Univ., Urbana. Coordinated Science Lab.
A SUPERCONDUCTING PARAMETRIC AMPLIFIER FOR THE MEASUREMENT OF SMALL DC VOLTAGES
Roger Ries Mar. 1967 52 p refs
(Contract DA-028-043-AMC-00073(E))
(R-344; AD-649514) CFSTI: HC $3.00/MF $0.65

A new device, capable of measuring minute dc voltages is described and a simple theory which describes the operation and predicts the performance is presented. Experimental amplifiers have demonstrated dc sensitivities which closely approach the maximum attainable by any device. Their performance characteristics agree satisfactorily with the theory. Sensitivities of 4X10 to the minus 14th power volts with a source resistance of 4X10 to the minus 7th power ohms and a time constant of nearly equal to 1

second have been obtained at 4.2K. The ultimate sensitivity appears to be limited only by the noise present in the source itself.
Author (TAB)

N67-28718# Fairchild Semiconductor Corp., Mountain View, Calif.
UHF INTEGRATED CIRCUIT TECHNOLOGY Quarterly Report, 15 Jul.–15 Oct. 1966
J. A. Archer and G. M. Purnaiya Mar. 1967 34 p refs
(Contract DA-28-043-AMC-01813(E))
(Rept.-2; QR-2; ECOM-01813-2; AD-649068) CFSTI: HC $3.00/MF $0.65

The report discusses the inverted common collector configuration and it is shown that an inductance having useful values of L and Q can be simulated. This simulated inductance has been applied in the design of a common emitter amplifier. The iterative properties of a single stage are discussed and a proposed two-stage amplifier is analyzed. Amplifier performance is predicted in some detail by both approximate analytical methods and by detailed machine computations. It is also shown how Butterworth and Chebyshev type responses can be synthesized. The predicted performance of the circuit has been verified by the construction of a one-tenth frequency scale model for which data is given.
Author (TAB)

N67-28751*# National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.
THE REQUIREMENTS PLACED ON ELECTRON TUBES FOR SPACE APPLICATIONS
W. H. Kohl, C. M. Veronda, and R. W. Wilmarth Washington, NASA, Jan. 1967 12 p refs Presented at the 8th Natl. Conf. on Tube Techniques, New York, 20–22 Sep. 1966
(NASA-TN-D-3733) CFSTI: HC $3.00/MF $0.65 CSCL 09A

Basic concepts of reliability, the weight and size penalties imposed by space missions, and the environmental parameters of temperature, vibration, shock, radiation, and particle bombardment are discussed. The special requirements imposed by the absence of a gravitational field and by the sensitivity of magnetometers to stray magnetic fields are also reviewed. The need for further reduction of the weight penalty for microwave tubes, particularly in cooling systems, is pointed out. The introduction of more efficient heaters and cathodes is thought to be a partial solution of the problem.
K.W.

N67-28761*# Western Reserve Univ., Cleveland, Ohio.
[FUNDAMENTAL STUDIES ON SEMICONDUCTOR RADIATION DETECTORS] Annual Status Report, 1 Mar. 1966–28 Feb. 1967
Karl J. Casper 28 Feb. 1967 93 p refs
(Grant NsG-655)
(NASA-CR-84812) CSCL 09C

Details are presented on silicon and germanium lithium drifting apparatus, and the lithium drift process is described. A computer program was written for gamma ray photopeak fitting to aid in analyzing gamma spectra measured with lithium-drifted germanium detectors. The program is included, and the processing procedures are discussed. Further experiments using 22 and 160 MeV protons for determining the response of large volume silicon detectors are also reported. It was concluded that it is not feasible to use silicon detectors for protons with energy above 100 MeV if good resolution is needed, and that germanium detectors are more useful in this energy range.
N.E.N.

N67-28790*# Gulton Industries, Inc., Albuquerque, N. Mex. Data Systems Div.
GIMBAL POSITION CONVERTER Final Report
Robert C. Davis 10 Apr. 1967 56 p
(Contract NAS8-20655)
(NASA-CR-84830) CSCL 22D

Details are given on the design objectives, mechanical and electrical designs, and test results of the gimbal position converter. It was concluded that although the prototype exhibited high reliability, simplification resulting in a decrease in the number of system circuits and components would enhance overall system reliability. It is recommended that for future models of the converter, a tester should be designed that will accurately generate the 8 and 4 MHz clocks and simultaneously simulate the resolver output pulse widths in order to allow full range accuracy checks of the digitizers along with checks on the performance of the rest of the system.
L.E.W.

N67-28857# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy). Laboratori Nazionali di Frascati.
A SYSTEM OF AUTOMATIC REGULATION OF PHOTOMULTIPLIER GAIN AND OF RELATIVE CHAIN LINEAR ELECTRONICS [UN SISTEMA DI REGOLAZIONE AUTOMATICA DEL GUADAGNO DI UN FOTOMOLTIPLICATORE E DELLA RELATIVA CATENA ELETTRONICA LINEARE]
C. Bacci (Ist. Nazl. di Fis. Nucl., Rome), R. Baldini-Celio, and V. Bidoli 22 Feb. 1967 12 p refs In ITALIAN *Its* Nota Interna No. 352
(LNF-67/11)

Block and wiring diagrams of an automatic gain control (AGC) system for a photomultiplier that can compensate for temperature changes in the range of 0 to 50°C are given. Spectra of a barium titanate light source (type PEK 118) are portrayed using a multichannel analyzer. Without AGC two spectra result with attenuations of 1 and 2.81 for the dynode and anode respectively of the photomultiplier; with AGC the spectra coincide.
Transl. by P.F.E.

N67-28869# Nuklearni Institut Jozef Stefan, Ljubljana (Yugoslavia).
INFLUENCE OF THE PREPARATION CONDITIONS ON THE CAPACITANCE OF THE DOPED SINTERED Ti_2 COMPACTS
D. Kolar, M. Buh, and J. Puh Dec. 1966 6 p refs Presented at the Elec. and Magnetic Ceram., London, 6–7 Dec. 1966
(NIJS-R-492) CFSTI: HC $3.00/MF $0.65

The influence of the addition of small amounts of Sb_2O_3 and preparation conditions on the capacity and dissipation factor (tangent of the loss angle) of small ceramic capacitors (ϕ 10 mm,h 1 mm) made from TiO_2 were investigated. Curves capacitance vs. loss angle, capacitance vs. temperature, and resistance vs. applied voltage indicate that the capacitors could be used in low-voltage circuits. Capacitors with typical values 8000 pF/cm^2 surface (tg of the loss angle 0.01) and 16,000 pF/cm^2 (tg of the loss angle 0.025) were repeatedly prepared.
Author

N67-28905# Radio Corp. of America, Somerville, N. J. Defense Microelectronics Activity.
HIGH PERFORMANCE THIN FILMS FOR MICROCIRCUITS Quarterly Report, 1 Sep.–30 Nov. 1966
Franz Huber, William Laznovsky, and Walter Witt Mar. 1967 25 p
(Contract DA-28-043-AMC-01230(E))
(ECOM-01230-7; Rept.-7; AD-650041) CFSTI: HC $3.00/MF $0.65

The rate of hafnium films deposited with a new sputtering system has been studied in more detail. A hexagonally shaped substrate holder, which rotates to six different positions, allows performance of 5 sputtering runs without breaking the vacuum. Hafnium films can be deposited at a rate of 1200 A/min with a sputtering voltage of 2800 volts after the cathode has been cleaned in a pre-sputtering cleaning cycle lasting 60 minutes. The uniformity of the hafnium films over a 3x5 inch area is plus or minus 2% if a cathode of 6x6 inch size is utilized. A floating technique for hafnium-hafnium-dioxide capacitors has been developed and crystallographic examination of these films has been started.
Author (TAB)

N67-28920# Army Electronics Labs., Fort Monmouth, N. J.
ANALYSIS OF THE EFFECT OF FERRITE ON THE INTERACTION FIELDS IN A TRAVELING-WAVE TUBE
Arthur H. Gottfried Jan. 1967 37 p refs
(ECOM-2796; AD-650472) CFSTI: HC $3.00/MF $0.65

An analysis was made of the effect on the interaction fields outside the helix of a traveling-wave tube when a ferrite cylinder, d-c magnetized in the circumferential direction, is placed inside the helix. It is shown that the main effect is the introduction of a slowing factor for the phase velocity of the slow waves. This phase velocity is independent of the strength of the d-c magnetic field, but is proportional to (1 + epsilon/epsilon sub o) to the 1/2 power, where epsilon/epsilon sub o is the relative dielectric constant of the ferrite. It is also shown that the backward-wave modes are cut off for certain values of d-c magnetic field. Author (TAB)

N67-28943# Navy Electronics Lab., San Diego, Calif.
COMPLEMENTARY HEATING OF DENSELY PACKAGED MICROCIRCUITS Research and Development Report, Sep.–Nov. 1966
H. F. Dean 6 Feb. 1967 20 p refs
(NEL-1433; AD-650032) CFSTI: HC $3.00/MF $0.65

Some microcircuits dissipate as much as equivalent circuits using discrete transistors and resistors. Dense packaging and the resultant complementary heating therefore create reliability problems similar to those experienced with discrete components. Author (TAB)

N67-28944# General Electric Co., Schenectady, N. Y.
INVESTIGATION OF VARIOUS ACTIVATOR REFRACTORY SUBSTRATE COMBINATIONS Final Report
J. H. Affleck and W. T. Boyd Griffiss AFB, N. Y., RADC, Jan. 1967 55 p refs
(Contract AF 30(602)-3395)
(RADC-TR-66-656; AD-649885) CFSTI: HC $3.00/MF $0.65

The investigation was a study of various thin film refractory substrate combinations capable of producing high current density in dispenser type cathodes. Work function was used as the fundamental property common to all systems in evaluating the emission properties of the various dispenser cathode systems fabricated and evaluated during this program. The cathode systems were evaluated in a beam tester at both dc and pulsed operation and a barium-strontium-tungstate cathode produced dc emission in excess of 30 amperes per sq cm for a period of nine hours in a saturated emission condition. It is generally concluded that the dispenser cathode is capable of high current densities for use in devices where 1 to 2 amperes per sq cm is a requirement and dc or long duty cycle operation is desirable. Author (TAB)

N67-28968# Motorola, Inc., Phoenix, Ariz. Semiconductor Products Div.
THIN FILM RC NETWORKS FOR SILICON INTEGRATED CIRCUITS Quarterly Report, 1 Nov. 1966–30 Jan. 1967
Louis Terry Mar. 1967 39 p refs
(Contract DA-28-043-AMC-02212(E))
(Rept.-2; QR-2; K-27; ECOM-02212-2; AD-650516) CFSTI: HC $3.00/MF $0.65

Areas of investigation were: maximum useable resistance of TaSi2, Cr3Si, Al203 films increased to 10,000 ohms per square with TCR = −300 ppm/c. Started evaluation of flash evaporated As205 + metal powder for R sub S > or = 15,000 ohm-per-square cermet resistors. 1000 hour, 200C storage tests completed on 100 5k ohm-per-square cermet resistors. No failures were observed and maximum resistance change was less than 1 percent. Preliminary investigation of the properties of the following rf sputtered dielectrics: (a) TiO2 films sputtered from pressed TiO2 sources; (b) titanate films sputtered from a pressed BaTiO3 source and from a 'doped' BaTiO3 source. Defined sputtering conditions for depositing 'good' Al films to be used as capacitor bottom electrodes, i.e., Al which shows little change in structure with 450C air bakes. Deposited and trimmed 25K ohm-per-square cermets on two-gate MiCc50 gate circuit wafers. Design and breadboard evaluation was completed of an IF amplifier. The integrated circuit version will contain 6 thin film capacitors and 12 thin film resistors. Mask layout work for the integrated IF amplifier is in process. Author (TAB)

N67-28972# Westinghouse Electric Corp., Pittsburgh, Pa. Research Labs.
TUNED INTEGRATED CIRCUITS Quarterly Report, 1 Oct.–31 Dec. 1966
W. E. Newell and S. M. Zalar Mar. 1967 33 p ref
(DA-28-043-AMC-02045(E))
(QR-3; Rept.-67-9F1-NEWSC-P1; ECOM-02045-3; AD-650189) CFSTI: HC $3.00/MF $0.65

By more precise control over the density of cadmium molecular vapors, important improvements in the fabrication of CdS thick films (5-20 microns) have been achieved. Studies of the piezoelectric performance of metal-CdS-metal structures, vacuum deposited on glass substrates and acoustically activated within the frequency range of 100 to 300 MHz, indicate that CdS film resonances appear mostly in the form of envelope-modulation of substrate resonances. In order to incorporate substrate resonances more constructively into the metal-CdS-metal structure, thermally grown silica membranes (up to 11 microns thick) have been produced. Author (TAB)

10 ELECTRONICS

Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see: Specific Physics Categories.

N67-27832 Joint Publications Research Service, Washington, D. C.
THE MEASUREMENT OF SMALL VELOCITY FLUCTUATIONS IN AUTOMATIC CONTROL SYSTEMS
V. V. Andrushchuk, and V. N. Sharakhin *In its* Izv. VUZov: Instr. Bldg., Vol. 9, No. 6 27 Mar. 1967 p 45–49 refs (See N67-27821 15-14)

Details are given on a method of measuring small fluctuations of angular velocity by disclosing and differentiating the phase of the pulses furnished by a stable-frequency oscillator and taken off a pickup. Noninertial properties are obtained by discharging the capacitor in each period of the carrier frequency. Author

N67-27841 Joint Publications Research Service, Washington, D. C.
INVESTIGATION OF NONLINEARITY ERRORS OF STORING CIRCUITS
G. P. Pol'dyayev *In its* Izv. VUZov: Instr. Bldg., Vol. 9, No. 6 27 Mar. 1967 p 85–90 refs (See N67-27821 15-14)

Nonlinearity errors of storing circuits containing detectors and storing capacitors are analyzed. The expressions derived for the relative nonlinearity errors are based on the allowable accuracy in two different cases of approximating the charge characteristics of storing capacitors; a relationship is established for these two cases. An example of calculating errors of storing circuits due to nonlinearity is given. Author

N67-27963# Army Missile Command, Huntsville, Ala. Army Inertial Guidance and Control Lab.
A STUDY OF SUB-OPTIMAL CONTROL LAWS

Kelly V. Grider *In* Army Dept. Proc. of the 1966 Army Sci. Conf., Vol. I 26 Aug. 1966 p 389–403 refs (See N67-27941 15-34)
(AD-634685)

Three different admissible sub-optimal control law structures are considered that permit the transfer of a system from a specified initial condition to a specified terminal condition. The sub-optimal control law structure is specified *a priori* so that problem becomes one of optimizing certain adjustable parameters within the structure. For a dynamical system of arbitrary order, the relationship of the optimal vector to the plant matrix, performance matrix, and initial state of the plant are developed, and optimal controller coefficients are obtained when the structure of the control law is restricted to a special linear saturation type. A direct method to obtain the performance index, in terms of the initial state and the controller gain vector, can be used to determine optimal controller coefficients in the case of special linear switching. This second order example shows that the optimal vector is not constant over a region of state space. M.W.R.

N67-28104 Joint Publications Research Service, Washington, D. C.
OPERATING CONDITIONS OF SEMICONDUCTOR POLYPHASE MULTIVIBRATOR
V. I. Belitskiy *In its* Izv. VUZov: Instr. Bldg., Vol. 9, No. 2 23 Feb. 1967 p 12-18 refs (See N67-28101 15-14)

The possibility of polyphase multivibrators generating both relaxation and continuous vibrations is demonstrated. The theoretical conclusions are confirmed by experiment. Author

N67-28107 Joint Publications Research Service, Washington, D. C.
METHOD OF AUTOMATIC SEPARATION OF LOSSES IN MAGNETIC MATERIALS
V. Ya. Ivanova, D. I. Zorin, N. V. Malygina, and G. N. Novopashennyy *In its* Izv. VUZov: Instr. Bldg., Vol. 9, No. 2 23 Feb. 1967 p 29–32 (See N67-28101 15-14)

Details are given on an automatic method of dividing full losses in magnetic materials into two components: losses through hysteresis, and losses through eddy currents. The diagram of a unit for separating losses is proposed, and errors occurring in this method are evaluated. Author

N67-28109 Joint Publications Research Service, Washington, D. C.
QUALITY IMPROVEMENT OF DIGITAL SMOOTHING FILTERS WITH LIMITED TRANSIENT TIME
A. I. Bobikov and Yu. M. Korshunov *In its* Izv. VUZov: Instr. Bldg., Vol. 9, No. 2 23 Feb. 1967 p 38–41 refs (See N67-28101 15-14)

An analysis is presented on the effect of lag in digital smoothing filters with limited transient time on filter quality. It is demonstrated that a proper choice of lag value makes it possible to substantially improve the quality of smoothing filters. Author

N67-28111 Joint Publications Research Service, Washington, D. C.
QUALITY PERFORMANCE OF SERVOMECHANISM WITH GAP-TYPE NONLINEARITY
V. A. Khokhlov *In its* Izv. VUZov: Instr. Bldg., Vol. 9, No. 2 23 Feb. 1967 p 46–52 refs (See N67-28101 15-14)

The rating of transient process quality indices is examined in a typical instrument servo containing gap-type nonlinearity in the feedback circuit. Computation is effected on the basis of harmonic linearization of nonlinearity and finding a predominant pair of complex-conjugated roots of a linearized characteristic equation by the root trajectory method. Author

N67-28112 Joint Publications Research Service, Washington, D. C.
REGISTERING QUANTIZATION LEVEL IN MODELING DIGITAL SERVOMECHANISMS
I. D. Cherepenin *In its* Izv. VUZov: Instr. Bldg., Vol. 9, No. 2 23 Feb. 1967 p 53–56 ref (See N67-28101 15-14)

A method is described for modeling stepped quantizer characteristics by level, constituting a substantial element in digital servo-mechanisms (DSM). The stepped characteristics of the quantizer are reproduced with the aid of nonlinear block, in which a reversing spaced scanner is employed. A method is indicated for determining scale factors for shifting from real DSM parameters to analog computer machine parameters. Author

N67-28113 Joint Publications Research Service, Washington, D. C.
INVESTIGATION OF AUTOVIBRATIONS IN A SERVOMECHANISM WITH STEP-BY-STEP SERVOMOTOR
M. N. Glazov *In its* Izv. VUZov: Instr. Bldg., Vol. 9, No. 2 23 Feb. 1967 p 57–62 refs (See N67-28101 15-14)

A relay servomechanism with step-by-step servomotor and dual-series magnetic amplifier is examined. Autovibrations in such a system can be analyzed by the harmonic linearization method. A comparison of figures obtained through calculations and experiment is included. Author

N67-28114 Joint Publications Research Service, Washington, D. C.
PULSE FREQUENCY CONTROL DEVICE
A. L. Gurevich and L. A. Rusinov *In its* Izv. VUZov: Instr. Bldg., Vol. 9, No. 2 23 Feb. 1967 p 63–69 refs (See N67-28101 15-14)

Attention is focused on the principles of design and structural arrangements of discrete pulse frequency series-functioning devices for industrial plant control systems, interpolators, series-functioning digital integrators, etc. Recommendations are given for circuit arrangement for various applications. A study is made of output pulse momentary frequency, and a method for reducing it is described. Author

N67-28115 Joint Publications Research Service, Washington, D. C.
DETERMINATION OF EQUIVALENT TRANSFER FUNCTION OF FOUR-TERMINAL OPERATIONAL NETWORK ACCORDING TO FREQUENCY CHARACTERISTICS
B. M. Yakovlev *In its* Izv. VUZov: Instr. Bldg., Vol. 9, No. 2 23 Feb. 1967 p 70–75 refs (See N67-28101 15-14)

A determination is made of equivalent transfer function of a four-terminal operational network between an ideal modulator and demodulator. A study is made of its relation with the demodulator reference voltage phase. A method of building a transfer function hodograph, according to the four-terminal operational network phase characteristics, is examined. Author

N67-28116 Joint Publications Research Service, Washington, D. C.
INVESTIGATION OF ELECTROCHEMICAL CONTROLLED RESISTANCES
V. S. Borovkov and V. V. Treyyer *In its* Izv. VUZov: Instr. Bldg., Vol. 9, No. 2 23 Feb. 1967 p 78–80 refs (See N67-28101 15-14)

An experimental study was conducted on electrochemical controlled resistors (chemical memistors), which consist of a readout electrode with insulated end terminals and a control electrode placed in a hermetically sealed galvanic bath. A metal film is electrochemically deposited on the readout electrode or removed, which provides variable resistance between terminals. Readout of resistance value is effected by alternating current without film

breakdown. Consideration is given to the relation between resistance change in time during the deposition and removal of film on the readout electrode surface for various control currents, and to the element resistance value relationships at various readout current frequencies for differing thicknesses of metal film on the readout electrode surface. Results show that resistors with readout electrodes of a fine platinum or rhodium film have more stability and better reproducibility from sample to sample than elements with a fine carbon film. M.G.J.

N67-28118 Joint Publications Research Service, Washington, D. C.
PROBLEMS OF BUILDING LOGICAL CIRCUITS WITH MULTIROD MAGNETIC ELEMENTS
V. B. Smirnov *In its* Izv. VUZov: Instr. Bldg., Vol. 9, No. 2 23 Feb. 1967 p 86–89 refs (See N67-28101 15-14)

Some logical possibilities of multirod magnetic elements with magnetic flux commutation are examined. Methods are given for realization of Pierce's function and Boolean functions presented in disjunctive form. Author

N67-28129 Joint Publications Research Service, Washington, D. C.
UNCORRELATED METHOD OF RELIABILITY CALCULATION OF AUTOMATIC SYSTEMS
A. A. Bessonov *In its* Izv. VUZov: Instr. Bldg., Vol. 9, No. 2 23 Feb. 1967 p 141–146 refs (See N67-28101 15-14)

Consideration is given to the possibilities of forecasting reliability of automatic systems by evaluating the correspondence of their properties to the generalized function. This makes it possible to eliminate unwieldy calculations and ignore correlation between random variables. Author

N67-28155# Joint Publications Research Service, Washington, D. C.
CYBERNETICS IN ECONOMY AND INDUSTRY
1 Mar. 1967 25 p refs Transl. into ENGLISH from Russian (JPRS-40084; TT-67-30731)

CONTENTS:

1 CYBERNETICS IN ECONOMICS—ON ONE ITERATIVE METHOD OF SOLVING PROBLEMS OF INTEGRAL PROGRAMMING I. I. Pyatetskiy-Shapiro, V. A. Volkonskiy, L. V. Levina, and A. Pomanskiy p 1–5 refs (See N67-28156 15-08)

2. INTERMITTENT-ACTION PNEUMATIC COMPUTER ENGINEERING E. V. Fudim p 6–10 ref (See N67-28157 15-08)

3. INDUSTRIAL TEST OF OPEN-LOOP PART OF CONTROL SYSTEM OF A DEVICE FOR CONTINUOUS COOKING OF MASSECUITE L. Z. Amlins'kyy and V. I. Neskhodovs'kyy p 46–52 (See N67-28158 15-10)

N67-28158# Joint Publications Research Service, Washington, D. C.
INDUSTRIAL TEST OF OPEN-LOOP PART OF CONTROL SYSTEM OF A DEVICE FOR CONTINUOUS COOKING OF MASSECUITE
L. Z. Amlins'kyy and V. I. Neskhodova'kyy *In its* Cybernetics in Economy and Ind. 1 Mar. 1967 p 11–19 refs Transl. into ENGLISH from Avtomatyka (Kiev), v. 6, 1966 p 46–52 (See N67-28155 15-10)

The open-loop part of a control system designed to control the continuous cooking of massecuite (that part of the sugar syrup which contains crystals) in an industrial sugar crystallization process, is described. The circuitry of the open loop storage device is depicted, along with a block diagram of the RCH-1 component of the open loop, and a block diagram of the general structural control system. Methods of testing parameters of the system in (temperature and voltage input) in industrial operation are described; and established results are presented. The correctness of choice of the entire complex of elements which effect the feeding of information on disturbance effects into the control circuit, was confirmed. L.S.

N67-28189# Harry Diamond Labs., Washington, D. C.
ASPECTS OF DIELECTRIC CONSTANT AND LOSS MEASUREMENTS AT 100 MHz
Z. G. Sztankay Nov. 1966 38 p refs
(HDL-TR-1329; AD-649324) CFSTI: HC$3.00/MF$0.65

Despite errors introduced into 100-MHz capacitance measurements by series inductances associated with the dielectric sample holder, a modified Hartshorn-Ward micrometer method currently employed for solid samples circumvents these difficulties and yields proper results for dielectric constant and loss tangent. For cases where the modified Hartshorn-Ward method cannot be used (e.g. with liquid samples), equations are derived to correct the dielectric constant and loss measurements, using a double L-section equivalent circuit, which is shown to be representative of a standard sample holder. Equations are also derived to permit calculation of dielectric constant and loss tangent using only the Q-meter Q readings and sample-holder plate separations without subsequent low-frequency capacitance determinations, which had normally been employed with the modified Hartshorn-Ward method. Author (TAB)

N67-28269# Polytechnic Inst. of Brooklyn, N. Y.
THE SYNTHESIS OF LINEAR DYNAMICAL SYSTEMS FROM PRESCRIBED WEIGHTING PATTERNS
Donte C. Youla Griffiss AFB, N. Y., RADC, Feb. 1967 29 p refs Repr. from J. SIAM Appl. Math., v. 14, no. 3, May 1966
(Contract AF 30(602)-2868)
(RADC-SP-66-11; AD-649128) CFSTI: HC$3.00/MF$0.65

The paper is addressed to several problems of synthesis associated with a linear system possessing the dynamical description: (1) $X(t) = F(t)x(t) + G(t)u(t)$, (2) $y(t) = H(t)x(t)$, where $x(t)$ is a state-vector (real n-vector), $y(t)$ is the output (real r-vector), $u(t)$ is the input (real p-vector), $F(t)$ is an n X n real matrix, $G(t)$ is a real n X p matrix, and $H(t)$ is a real r X n matrix. The state summarizes the evolution of the system in time. This evolution is affected by past history and the input stimulus $u(t)$. In the model the output $y(t)$ is a function of the present state $x(t)$. To avoid unessential complications it is assumed from the outset that all entries in the three matrices $F(t)$, $G(t)$ and $H(t)$ are square-integrable (and hence integrable) over any finite interval of time. Author (TAB)

N67-28419# Comitato Nazionale per l'Energia Nucleare, Rome (Italy).
PROSPECTIVENESS OF ORGANIC ELECTRONICS [PROSPETTIVE DELL'ELETTRONICA ORGANICA]
G. Caserta, T. Cervigni, F. Fioroni, and B. Rispoli 1966 15 p refs In ITALIAN
(RT/EL/66/-10)

A review of the most important charge transfer phenomena observed in some organic materials is developed. The review emphasizes the possibility of using such organic materials as electronic functional devices, electronic circuit components and nuclear detectors. Author (NSA)

N67-28484# General Electric Co., Philadelphia, Pa. Missile and Space Div.
STUDY OF AVALANCHE TYPE SEMICONDUCTOR RADIATION DETECTORS OBTAINED THROUGH SURFACE CONTOURING Semiannual Report, Jul. 1966–Jan. 1967

Gerald C. Huth, Robert J. Locker, Russell A. McKinney, Donald F. Yerry, and Frank M. Cosmi 1967 75 p refs
(Contract AT(30-1)-3246)
(NYO-3246-9) CFSTI: HC $3.00/MF $0.65

A study of avalanche type semiconductor radiation detectors obtained through surface contouring is presented. The study was undertaken in three sections: basic semiconductor research concerned with the optimization and evolution of the deep diffused avalanche detector structures, development of detector associated circuitry which takes maximum advantage of the fast avalanche amplification process, and a finite effort to apply avalanche detectors and instrumental concepts thus far developed to specific detection problems in other laboratories. NSA

N67-28572# Illinois Univ., Urbana.
AN EQUIVALENT GAIN AND STOCHASTIC ANALYSIS FOR NONLINEAR SAMPLED DATA CONTROL SYSTEMS
Roi Francis Prusher, Jr. (Ph.D. Thesis) Wright-Patterson AFB, Ohio, AF Inst. of Tech., 1966 147 p refs
(AFIT-TR-67-1; AD-647846) CFSTI: HC $3.00/MF $0.65

In this thesis, a generalized equivalent gain function for nonlinear sampled-data control systems is defined and is specified to be the ratio of the z-transform of the crosscorrelation function of the system input and output signals to the z-transform of the autocorrelation function of the system input signal. Although this definition can be used to derive the usual describing function when the input is sinusoidal, it is not restricted to the sinusoidal case. Consequently, it is fundamentally an equivalent gain function in the sense originally proposed by R. C. Booton, and it is a nonlinear element representation more general than the usual describing function. In the past, the techniques of describing function analysis have been helpful in nonlinear analysis and have furnished valid results. The applications of these techniques can be extended with the generalized equivalent gain function. The sinusoidal describing function and the discrete describing function become special cases of the equivalent gain function when the input is restricted to sinusoidal variations and a sampled-data system is studied. The equivalent gain function can be used for general deterministic input systems and can also be used for systems with stochastic input signals. TAB

N67-28626# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DESIGN OF RADIO ENGINEERING INSTRUMENTS
V. F. Barkan and V. K. Zhdanov 25 Jan. 1967 652 p refs Transl. into ENGLISH of the book "Proyektirovaniye Padiotekhnicheskikh Ustroystv" Moscow, 1963 515 p
(FTD-HT-66-265; AD-651074) CFSTI: HC $3.00/MF $0.65

The book is a student handbook in coarse and graduate design for technicians specializing in radio engineering. The handbook proposes a general method of design for low frequency amplifiers, video amplifiers, radio receiving and transmitting equipment. It shows the calculation of low and high frequency radio circuits, and gives examples of the calculation involving vacuum tubes and transistors. This book represents an attempt to systematize the methods of rough and technical design and computation of radio receiving and transmitting devices, low-frequency and video amplifiers, as well as typical stages using semiconductors, within an approved curriculum. The first four chapters explore the general problems in undergraduate and graduate design, and in approximate calculations. In the remaining chapters, the method of technical design is demonstrated and examples are given. The book provides basic mathematical relations and formulas, as well as a methodology and examples of problem solutions. Comparative characteristics of the physical peculiarities in uniform cascaded stages are included. Required handbook data for computations is given in the text and in appendices at the back of the book. Author (TAB)

N67-28630# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SELF-MONITORING, SELF-CORRECTION AND SELF-REPAIR AS MEANS TO IMPROVED RELIABILITY OF COMPLEX DIGITAL SYSTEMS
A. D. Radchenko 25 Jan. 1967 23 p refs Transl. into ENGLISH from the Russian
(FTD-HT-66-597; AD-650804) CFSTI: HC $3.00/MF $0.65

Correcting codes are used widely for increasing the reliability of communications equipment and digital computers. If the errors do not exceed a certain magnitude, the system does the correcting; however, the reliability emphasis is shifted to the correcting filter, and a defect in the filter may introduce additional perturbations. The present article proposes a method for increasing the reliability of the correcting filters and other devices by means of secondary (internal) coding. The required design redundancy is moderate compared with complete duplication. During the wearing-out process spare components are introduced only for those components which actually went out of operation. The article also discusses the self-diagnosis of possible failures and their self-repair. Mechanical repairs can be avoided by introducing learning matrices and the learning process leads to the establishment of contacts between appropriate bushbars. Author (TAB)

N67-28650*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
CONTROL SYSTEMS
In its Res. and Advanced Develop., Vol. II 31 Jan. 1967 p 227–235 refs (See N67-28641 15-34)

Digital control methods and digital simulation techniques are being developed for the control systems necessary for a landed operation on Mars, science and telecommunications pointing requirements, and data reduction for the electrostatically suspended gyro (ESG). Advanced attitude control optimization techniques are being considered for Mars landing and landed control systems. M.W.R.

N67-28699# Autonetics, Anaheim, Calif.
RADIATION EFFECTS ON THIN-FILM INTEGRATED CIRCUIT ELEMENTS Quarterly Report, 15 Oct. 1966–14 Jan. 1967
V. H. Strahan and A. F. Krueger 24 Apr. 1967 54 p refs
(Contract DA-28-043-AMC-01467(E))
(C7-420/501; Rept.-6; QR-1; ECOM-02431-1; AD-651144) CFSTI: HC $3.00/MF $0.65

The efforts of this quarter were directed toward a review of the past work on this program with the objective of uncovering areas of data and information which may have been missed or not fully exploited. The general features of all previous data were reviewed. The overall wave shapes of the signals were tabulated from both the electrode and counter electrode of each capacitor studied. These tabulations were made for irradiation in air and in vacuum at $V_0 = +40$, 0, and -40 volts. To gain further information about secondary emission replacement currents, plots of the V delta 1+V delta 2 versus V_0 data were prepared for as many as possible of the previously studied capacitors. These plots represent the net replacement current which occurs in the capacitor during irradiation. Author (TAB)

N67-28769*# Missouri Univ., Columbia. Dept. of Electrical Engineering.
SENSITIVITY ANALYSIS Progress Report, 1 Mar.–1 May 1967
W. W. Happ (NASA, Electron. Res. Center), G. W. Zobrist, and M. J. Devaney [1967] 12 p refs Presented at 10th Midwest Circuit Symp., Lafayette, Ind., 18–19 May 1967
(Grant NGR-26-004-035)
(NASA-CR-84818) CFSTI: HC $3.00/MF $0.65 CSCL 09C

The problem of calculating the sensitivity coefficients can be resolved efficiently if an analytical expression for the network

function is available. The flowgraph technique provides a partial answer to this problem, since a symbolic representation of the network function can be obtained directly from the flowgraph. A brief discussion of flowgraph techniques is presented; the discussion is based on the dichotomy of the equivalent network. Sensitivity formulas are also developed from the basic topology equation of the flowgraph. A computer program has been written which utilizes an efficient algorithm to solve the topology equation, H=0. The network is encoded using a code for each element which completely characterizes the network. Dependent and independent sources can be handled and the method is being extended to nonlinear networks. Examples of sensitivity calculations are presented for both passive and active networks. The equivalent circuit, network coding, and computer printout are included for each example.
Author

N67-28840*# Massachusetts Inst. of Tech., Cambridge. Dept. of Electrical Engineering.
COMPUTATION OF APPROXIMATE FUEL-OPTIMAL CONTROL
Donald Lee Gray (Ph.D. Thesis) May 1967 104 p refs
(Grants NsG-496; NGR-22-009(124); MIT Proj. DSR 76265)
(NASA-CR-84835; ESL-R-307) CFSTI: HC $3.00/MF $0.65
CSCL 22C

An iterative digital computer method for determining the optimal control function is developed and tested. The class of problem treated is fixed time fuel-optimal control of a linear time-invariant plant to a given point. A sequence of suboptimal controls is produced each of which is efficient in use of fuel and does not require the fast switching time of the optimal control. Convergence of the method is proven under suitable assumptions. A Fortran program is given and computer results are presented for a number of examples. These examples illustrate the usefulness of the method. Ways of extending the method to other classes of problems are outlined.
Author

11 FACILITIES, RESEARCH AND SUPPORT

Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

N67-27789# Royal Aircraft Establishment, Farnborough (England).
REPORT ON THE WORK COMMON TO DORNIER SYSTEM AND THE R. A. E. CARRIED OUT AT THE ROYAL AIRCRAFT ESTABLISHMENT, FARNBOROUGH AND AT THE PROOF AND EXPERIMENTAL ESTABLISHMENT AT PENDINE [BERICHT UEBER GEMEINSAME ARBEITEN VON DORNIER SYSTEM UND DEM R. A. E. BIEM ROYAL AIRCRAFT ESTABLISHMENT IN FARNBOROUGH UND BIEM PROOF AND EXPERIMENTAL ESTABLISHMENT IN PENDINE]
G. Langbein Nov. 1966 58 p refs Transl. into ENGLISH from German
(RAE-LIB-TRANS-1194) CFSTI: HC $3.00/MF $0.65

Investigations carried out using a whirling arm, an air gun, and a rocket sled are reported. Descriptions are given of the equipment setup and their operation. The whirling arm was used to investigate rain erosion of 1.5-mm thick 99.5% aluminum sheet as well as rain erosion properties of various synthetic materials, i.e., polystyrenes, polyvinylchloride, high density polyethylenes, irradiated polyethylene, and polyurethanes. Investigations conducted with the air gun dealt mainly with the effect of water drops on various synthetic materials in which the velocity was 300 m/s and the drops were 1.5 mm in diameter. It was found that the depth of the impression of a single drop impact increases as follows: polystyrene, Plexigum S70, and polyethylene. Rocket sled studies are briefly described, in which experiments were carried out with a velocity of 500 m/sec on ten materials. Results indicated that the ceramic specimens and the sapphire were not eroded; the most erosion-resistant glass was the Triplex glass. Other work related to these experiments, conducted at these and other facilities, is also summarized.
L.E.W.

N67-27806# Industrieanlagen-Betriebsgesellschaft G.m.b.H., Ottobrunn (West Germany).
DESIGN CRITERIA FOR A HIGH SPEED TEST FACILITY WITH ARC HEATER AND MHD-ACCELERATOR FOR SIMULATION OF ATMOSPHERIC ENTRY [AUSLEGUNGSKRITERIEN FUER EINE HOCHGESCHWINDIGKEITSVERSUCHSANLAGE MIT PLASMABRENNER UND MHD-BESCHLEUNIGER ZUR SIMULATION DES WIEDEREINTRITTS IN DIE ERDATMOSPHAERE]
H. Fritzsche [1966] 39 p refs In GERMAN; ENGLISH summary Presented at the Ann. Joint Meeting DGRR/WGLR, Bad Godesberg, W. Germany, Oct. 1966
(DGRR/WGLR Paper-66-115) CFSTI: HC $3.00/MF $0.65

Reentry problems at up to orbital velocities may be simulated by a wind tunnel using an arc heater and a magnetohydrodynamic accelerator. The design of the test facility is determined by the operational conditions of the MHD-accelerator. First the reentry corridor for lifting apace vehicles is fixed. After some general considerations relating the thermodynamic state of the gas in the test facility to the atmosphere and its corresponding velocities, an estimate of the accelerator capability is given. A special solution assuming a constant cross sectional area, constant temperature of gas, and constant jxB force is derived by applying the equations of a one-dimensional inviscid flow to a Faraday accelerator. This is discussed in further detail. The influence of friction is estimated and the avoidance of large Hall voltages is taken into account.
Author (ESRO)

N67-27879 Polish Academy of Sciences, Warsaw. Inst. of Nuclear Research.
PULSED ELECTRON BEAM VAN DE GRAAFF [AKCELERATOR VAN DE GRAAFFA Z IMPULSOWANA WIAZKA]
A. Sawicki, H. Rzewuski, T. Orzechowski, A. Hentszel, Z. Werner et al Nov. 1966 25 p Submitted for publication
(INR-764/II,III/E)

The adaptation of the electron Van de Graaff accelerator for pulse irradiation made by the Institute of Nuclear Research is described. The accelerator with the dc beam was put into operation in 1965 and was adapted in 1966 for pulse radiation damage investigations in semiconductors.
Author

N67-28184# Air Force Systems Command, Wright-Patterson AFB, Ohio. Systems Engineering Group.
FOAM RUNWAY FOR LANDING LIFTING RE-ENTRY CRAFT
Veryl V. Vary Aug. 1966 41 p refs
(SEG-TR-66-21; AD-649277) CFSTI: HC $3.00/MF $0.65

The design constraint which horizontal landing imposes upon a fixed-geometry hypersonic-maneuvering lifting body reentry craft is reviewed. Two representative manned, lifting-body, flight-test, research vehicles (M2-F2 and HL-10) are examined to show the volume and weight penalty due to landing gear and landing engine. The fundamental reasons why the landing-design constraint exists are reexamined and several means by which the constraint might be relaxed are postulated. Two similar concepts in which aqueous detergent foam would be used to create a synthetic atmosphere

or a synthetic lake with a controlled density profile are described and the principles by which these concepts would relax the design constraint and simultaneously remove the weight and volume penalty of landing gear, landing engine, and other landing-assist devices are discussed. An operational concept is described. A development program including analytical study model tests and flight tests is proposed. Author (TAB)

N67-28186# Massachusetts Inst. of Tech., Cambridge. Aerophysics Lab.
RECENT ADVANCES IN MAGNETIC BALANCE SYSTEMS (IV) Scientific Interim Report, Jan.–Nov. 1966
William Bousman, Alan Copeland, Eugene Covert, and Timothy Stephens Wright-Patterson AFB, Ohio, ARL, Oct. 1966 106 p refs
(Contract AF 33(615)-1470)
(ARL-66-0200; AD-649243) CFSTI: HC $3.00/MF $0.65

The results of continued studies on several aspects of magnetic balance systems are presented. The aspects studied include: (1) detailed studies of several classes of optical model position sensors; (2) development and proof testing of an automatic model injection and retrieval system and (3) detailed study of methods of producing roll torque including compatability with existing and future magnetic balance systems and experimental verification of the design on bench tests. It is concluded that two of the classes of optical position sensing systems can meet the desired sensitivity but that these systems are somewhat geometry dependant. A recommendation for a system that seems to overcome these difficulties is made. Author (TAB)

N67-28341# Oak Ridge National Lab., Tenn.
DESCRIPTION OF FACILITY RADIATION AND CONTAMINATION ALARM SYSTEMS INSTALLED IN THE METALS AND CERAMICS LABORATORY, BUILDING 4508
J. A. Russell, Jr. and D. J. Knowles 6 Dec. 1966 26 p
(Contract W-7405-ENG-26)
(ORNL-TM-1669) CFSTI: HC $3.00/MF $0.65

Facility radiation and contamination alarm systems were installed in the Metals and Ceramics Laboratory Building 4508 to continuously and automatically monitor neutron radiation (by three neutron rate-burst detectors) and air contamination (by five alpha and three beta-gamma constant air monitors) in the entire facility. These instruments and other components in the network provide health physics monitoring information, sound local alarms when abnormal conditions occur, and indicate the abnormal conditions on a central panel board. Operating personnel are first given warning when air-borne contamination detected by one of the air monitors reaches a preset caution level. A second warning is given when the high-level set point is reached. The neutron detectors operate rate or burst alarms when the alarm levels are exceeded. The building evacuation system operates automatically when two or more alpha air monitors detect a high level of air contamination or when two or more neutron monitors detect a neutron burst or high rate. Author (NSA)

N67-28367* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
APPLICATION OF EXHAUST DIFFUSERS FOR ROCKET ENGINE TESTING
Paul F. Massier and E. John Roschke 21 Aug. 1962 35 p refs
(Contract NAS7-100)
(NASA-CR-84791; JPL-TM-33-97) CSCL 14B

Performance of chemical propellant rocket engines designed for space flight cannot be determined completely by ground-level tests because the combination of design chamber pressure and nozzle expansion-area ratio would induce flow separation in the expansion portion of the nozzle. The supersonic exhaust diffuser is one type of device with which ambient pressure can be reduced below atmospheric to such a degree that flow separation will not occur during ground-level test firings. Regions of engine operating conditions for which exhaust diffusers may be applied successfully are discussed. A survey of experimental diffuser performance results obtained with various configurations, including constant-area diffusers, fixed-area second-throat diffusers, and adjustable-area second-throat diffusers, is presented. These results are compared with proposed theories based on a simplified model in attempts to predict supersonic diffuser performance. Auxiliary methods of improving performance such as primary mass extraction and secondary mass injection are discussed. Effects of nozzle shape, simulated gimbaling, and scaling are also presented. Author

N67-28406# California Univ., Berkeley. Lawrence Radiation Lab.
BUBBLE CHAMBER OPTICS. I: MODIFICATION OF ILLUMINATION SYSTEM FOR 82-INCH BUBBLE CHAMBER. II: ALIGNMENT OF CAMERA PORT WINDOWS
Duane U. Norgren 22 Nov. 1966 18 p refs Presented at the 51st Ann. Meeting of the Opt. Soc. of Am., San Francisco, 22 Nov. 1966
(Contract W-7405-ENG-48)
(CONF-661042-1; UCRL-17259) CFSTI: HC $3.00/MF $0.65

The use of coat hanger retro-reflectors in converting a 72-inch to an 82-inch bubble chamber is discussed. A short method for determining alignment tolerances for camera port windows is also presented. Author (NSA)

N67-28438# Brookhaven National Lab., Upton, N. Y.
PROTON SYNCHROTRONS FOR ENERGIES ABOVE 20 GeV
J. P. Blewett 1967 4 p refs Presented at the Natl. Particle Accelerator Conf., Washington, D. C.
(Contract AT(30-2)-GEN-16)
(BNL-11117; CONF-670307-10) CFSTI: HC $3.00/MF $0.65

Some details are presented of the CERN 28-GeV PS and the Brookhaven 33-GeV AGS improvement programs, which are aimed at increasing both the peak and average beam intensities and at adding to the experimental capabilities of both machines. Super-energy efforts involved in the design and construction of new accelerators are also discussed. Most advanced is the 70-GeV synchrotron at Serpukhov in the USSR. Also under construction in the USSR is a 25-GeV proton–antiproton storage ring. Design studies have reached a relatively complete preliminary stage for a 40-GeV machine in Japan, a 45-GeV accelerator in France, and for the American 200-GeV and European 300-GeV synchrotrons. Prospects for the development of super accelerators above 800 GeV in the distant future are briefly discussed. NSA

N67-28549# Avco-Everett Research Lab., Everett, Mass.
FEASIBILITY OF A HIGH PERFORMANCE AERODYNAMIC IMPULSE FACILITY Final Report
R. Leon Leonard and Peter H. Rose Dec. 1966 76 p refs
(Contract AF 33(615)-3074)
(AFFDL-TR-66-139; AD-651042) CFSTI: HC $3.00/MF $0.65

A study was conducted to ascertain the feasibility of a high performance aerodynamic impulse facility capable of producing a high velocity and high Reynolds number environment. Of many facilities considered, those most promising were magnetic annular arc tunnels and expansion tubes as single stage techniques, and a shock tunnel driving a j x B accelerator as a two stage technique. Experimental performance of the Magnetic Annular Arc (a new device for this application) implies that it can achieve the environment considered, but research directed more specifically to this goal must be performed. The expansion tube can theoretically achieve the conditions required, but experimental results indicate the prohibitive lengths and energies above 10 to the 8th power joules will be required to achieve the times necessary for aerodynamic testing. The shock tunnel driving a j x B accelerator necessary to achieve the environment will be physically large and consequently require above 10 to the 8th power joules energy, but experiments

thus far indicate no limitations which will prevent attainment of the desired environment. Author (TAB)

N67-28565# Naval Ordnance Lab., White Oak, Md.
INSTRUMENTATION OF A STANDARD DROP-WEIGHT TESTER FOR LIQUIDS
Harry E. Cleaver 2 Feb. 1967 26 p refs
(NOLTR-67-5; AD-649510) CFSTI: HC $3.00/MF $0.65

In order to investigate and define some of the variables involved in the impact testing of liquid explosives and monopropellants, a standard Olin Mathieson drop-weight tester was instrumented for dynamic pressure measurements and high speed camera studies. This instrumentation allows pressure measurements up to 7000 kgs/sq cm which is the calculated burst pressure of the rupture diaphragm in the sample cup assembly. The high speed camera studies provide a visual display of the impact - initiation - explosion process as it occurs in the sample cup assembly. Author (TAB)

N67-28573# Lockheed Missiles and Space Co., Sunnyvale, Calif.
WEIGHTLESSNESS SIMULATION USING WATER IMMERSION TECHNIQUES: AN ANNOTATED BIBLIOGRAPHY
Helen M. Abbott, John N. Duddy, and Dennis M. Kowall, comp. Feb. 1967 72 p refs
(LMSC-5-24-65-3/SB-65-2, Rev. 1; AD-649861) CFSTI: HC $3.00/MF $0.65

The compilation contains 141 selected references pertaining to biomedical and behavioral research involving immersion of human subjects. The references are organized under three principal topics: (1) Physiological Studies, including acceleration, impact protection and physiological responses to weightlessness simulations, (2) Human Engineering Studies, and (3) Techniques and Personal Equipment Requirements for immersion studies. The references are arranged alphabetically by author or title under each separate topic. An Author Index is included as an aid in locating specific investigators and publications. The references cited are considered to be the principal contributions to the literature during the period from 1951 through Jan. 1967, including both open and government sources. Author (TAB)

N67-28587# Polish Academy of Sciences, Warsaw. Inst. of Nuclear Research.
CONSTRUCTION AND TEST OF THE IMPULSE CAPACITOR 1.6 μF–70kV [KONSTRUKCJA I WYNIKI PROB KONDENSATORA IMPULSOWEGO 70 kV, 1.6 μF]
J. Nowikowski May 1966 20 p refs In POLISH; ENGLISH summary
(INR-710/XVIII/P)

The construction of an impulse capacitor with a capacitance of 1.6 μF and a working voltage of 70 kV is described. The capacitor is the basic unit of a condenser bank used for the investigation of plasma injectors. Author (NSA)

N67-28648*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SPACECRAFT VEHICLE ENVIRONMENTAL FACTORS
In its Res. and Advanced Develop., Vol. II 31 Jan. 1967 p 161–181 refs (See N67-28641 15-34)

Simulation of the permissive environment of space, or the molecular sink, is being investigated, as is the interaction of this sink with active environments in terms of effects on spacecraft mechanisms, optical elements, thermal control coatings, and biological activity. A study is underway to eliminate from a coating system those species produced by radiation that absorb significant amounts of thermal energy from the sun. Temperature control of large spacecraft is reported, including the thermal scale modeling of Mariner IV, transient scale modeling, and heat pipes and ducts. Conduction and radiation in spacecraft temperature control, solar spectrum measurement and simulation research, spacecraft radiation heat transfer, and temperature control model coating technology and materials are discussed. M.W.R.

N67-28676# Deutsche Versuchsanstalt fur Luft- und Raumfahrt, Troisdorf (West Germany).
FOG DISPERSAL OVER AIRPORT RUNWAYS BY MEANS OF A MECHANICAL METHOD [NEBELBESEITGUNG UEBER LANDEBAHNEN AUF FLUGPLAETZEN MIT HILFE EINES MECHANISCHEN ENTNEBELUNGS-VERFAHRENS]
Ulrich Schmieschek Mar. 1967 19 p refs In GERMAN; ENGLISH summary
(DLR-FB-67-23; DVL-618) CFSTI: HC $3.00/MF $0.65

Following a description of the fog dispersal procedure employing rotary sieves and after a brief résumé of fog dispersal experiments in the laboratory, a mobile plant for dispersing fog on aerodrome runways is described. Fog dispersal experiments which were carried out under natural fog conditions and which proved successful in considerably increasing visibility are finally disclosed. Author

N67-28802# Siemens-Schuckertwerke A. G., Erlangen (West Germany). Forschungslaboratorium.
INVESTIGATIONS OF MHD ACCELERATORS FOR WIND TUNNEL APPLICATIONS [UNTERSUCHUNGEN AN EINEM MHD-NACHBESCHLEUNIGER FUER WINDKANAELE]
H. Wittel [1966] 26 p refs In GERMAN; ENGLISH summary
Presented at the Ann. Joint Meeting DGRR/WGLR, Bad Godesberg, W. Germany, Oct. 1966 *Its* Meeting Paper No. 66–116
CFSTI: HC $3.00/MF $0.65

Simulation of reentry problems in ultra high speed wind tunnels uses magneto-hydrodynamics to accelerate the gases. The accelerating force per unit volume is proportional to the current density j and the magnetic field B. Both quantities, j and B have to be large to get a high accelerating force. The problems connected with high current densities in the MHD-duct are discussed, values in excess of 20 A/cm being reached. The voltage–current characteristics and the alternating current oscillograms reveal new mechanisms of current transition from the metallic electrode into the plasma. At high current densities this transition is regarded as a series of electrical breakdowns through the boundary layer distributed over the surface area. The occurrence and distribution of the sparks connected with these breakdowns depend on electrode surface and flow properties. The importance of electrical insulation problems in the accelerating duct, when water cooled metallic electrodes are used is discussed and possible solutions are proposed. Author (ESRO)

N67-28805# Aerodynamische Versuchsanstalt, Gottingen (West Germany). Abteilung Raumfahrt-Aerodynamik.
THE HYPERSONIC LOW DENSITY WIND TUNNEL OF THE AERODYNAMISCHE VERSUCHSANSTALT GOETTINGEN: OPERATIONAL BEHAVIOR AND FIRST RESULTS ON REAL GAS EFFECTS IN NOZZLE FLOWS [DER HYPERSONISCHE VAKUUMWINDKANAL DER AERODYNAMISCHEN VERSUCHSANSTALT GOETTINGEN: BETRIEBSVERHALTEN UND ERSTE ERGEBNISSE UEBER REALE GASEFFEKTE IN DUESENSTROEMUNGEN]
G. Koppenwallner Sep. 1966 34 p refs In GERMAN; ENGLISH summary Presented at the Ann. Joint Meeting DGRR/WGLR, Bad Godesberg, W. Germany, Oct. 1966 *Its* Meeting Paper No. 66–113
(AVA-FB-6612) CFSTI: HC $3.00/MF $0.65

The wind tunnel, designed for Mach numbers between 12 and 24 and stagnation temperatures up to 3000°K, is described. The measurements have been made in a Mach number range between Mach numbers 19 and 24 and at stagnation temperatures up to 2500°K at stagnation pressures between 30 and 200 ata. In these tests the influence of stagnation pressure P_0 and stagnation temperature T_0 on the static pressure distribution along the nozzle, on the Mach number distribution in the test section, on the diffusor pressure recovery and on the condensation of the gas is examined. Author (ESRO)

N67-28823*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
THE EFFECTS OF TRACKING STATION LOCATION UNCERTAINTY AND MEASUREMENT BIAS ERRORS DURING PHASES OF THE APOLLO MISSION
J. L. Cooley Feb. 1967 13 p refs
(NASA-TM-X-55803; X-507-67-60) CFSTI: HC $3.00/MF $0.65 CSCL 09F

The results of a study to evaluate the influence of measurement noise, measurement bias, and station location uncertainties on the capabilities of the ground navigation system during the earth orbital, translunar, lunar orbital, and transearth phases of the Apollo mission are presented. Primary emphasis is placed upon the relative effects of measurement bias and station location uncertainties on the spacecraft position and velocity errors during each phase of the mission. Thus the relative importance of measurement bias and station location uncertainties may be evaluated. Author

N67-28867# Avco-Everett Research Lab., Everett, Mass.
EXPERIMENTAL PERFORMANCE OF A j×B ACCELERATOR AUGMENTED SHOCK TUBE
R. Leon Leonard May 1967 24 p refs Submitted for publication
(Avco-Everett Res. Rept.-269) CFSTI: HC $3.00/MF $0.65

Experiments were performed in an electric arc driven shock tube augmented by a j×B accelerator operating on the seeded helium driver gas. Measurements were made of the accelerator inlet conditions, accelerator performance, and resulting shock tube performance. Current distributions measured in the accelerator at less than 400 MW power level were qualitatively predicted from a steady flow analysis with supersonic flow. Operation above 400 MW resulted in choking and performance deterioration due to boundary layer and joule heating effects. Shock tube performance was improved over that of a conventional electric arc driven shock tube and reached above 16 mm/μs shock velocity. Test time was achieved in about 1/3 of the runs made with the accelerator operating. Author

N67-28893# Air Force Systems Command, Wright-Patterson AFB, Ohio. Research and Technology Div.
EFFECTS OF PRESSURE VESSEL GEOMETRY ON THE INTERIOR BALLISTICS OF GAS GUNS Final Report, Sep. 1965–Jan. 1966
Wilhelm F. Knackstedt and Jay L. Politzer Dec. 1966 254 p ref
(AFFDL-TR-66-159; AD-649244) CFSTI: HC $3.00/MF $0.65

An analytical treatment of the performance of a gas gun was carried out by means of a modified Lagrange approximation. The actual local cross-sectional area of the high-pressure vessel of the gas gun, larger than the area of the base of the guns barrel, was taken into account and its effect on the performance determined. Author (TAB)

N67-28947# Naval Radiological Defense Lab., San Francisco, Calif.
THE NRDL GAMMA-/X-RAY SCATTERING FACILITY
Walter J. Gurney 22 Dec. 1966 46 p refs
(USNRDL-TR-67-14; AD-649998) CFSTI: HC $3.00/MF $0.65

A dual detector facility for measuring scattered gamma or x-radiation is described. This facility which uses highly shielded and collimated detectors, (NaI (Tl) and Ge(Li)), and a multi-channel pulse height analyzer, is capable of measuring the spectra of scattered radiation at angles from 1.3 to 135 degrees. Spectral measurements of scattered 137Cs gamma rays (661.6 keV) are currently being made; however, scattering measurements with primary photon energies ranging from 40 keV to 200 keV are planned. Energy resolutions (137Cs gamma rays) of the 4 x 4 in. NaI (Tl) detector and the 8 mm (w) × 18 mm (l) × 6 mm depletion depth Ge(Li) detector are 8.16% and approx. 2.86 keV respectively. Cross sections for differential coherent and incoherent scattering, as well as the photo-electric and the total mass absorption coefficients can be measured using this apparatus. Author (TAB)

12 FLUID MECHANICS

Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

N67-27813 Institut Franco-Allemand de Recherches, St. Louis (France).
REFLECTION OF WEAK SHOCK WAVES [REFLEXION DES ONDES DE CHOC DE FAIBLE INTENSITE]
A. Auriol, C. Thery, and J. B. Noyere 9 Jul. 1965 67 p refs In FRENCH
(T-20/65)

Known results from intense shock wave experimentation have been applied to a study of weak shock wave reflections. At an approximate angle of incidence of 90°, the coefficient of reflection is compared with waves of greater incidences. Emphasis is on the two-dimensional case of shock waves in stationary, supersonic flow. Transl. by R. Li.

N67-27872# Aeronautical Research Council (Gt. Brit.)
APPROXIMATE CALCULATIONS OF THE IMCOMPRESSIBLE LAMINAR BOUNDARY LAYER
M.R. Head and N. Haysai (Lockheed–Georgia Co.) 15 Nov. 1966 24 p
(ARC-28507) CFSTI: HC $3.00/MF $0.65

A recent calculation method proposed by Curle has been applied to the flow $U=\xi e^{-\xi}$ for which a computer solution exists. An earlier approximate method due to Head, presented here in simplified form, has been applied to the same problem. All three solutions are found to be in close agreement. A further problem, already examined by Curle, is treated by Head's method. Again the results are in good agreement with each other and with an exact solution obtained subsequently. Author

N67-27934# Atomic Energy Commission Research Establishment, Riso (Denmark).
AN EXPERIMENTAL STUDY OF THE TANGENTIAL VELOCITY PROFILE IN THE RANQUE–HILSCH VORTEX TUBE
C. U. Linderstroem-Lang Sep. 1965 18 p refs
(Riso-116) CFSTI: HC $3.00/MF $0.65

In connection with a study of the gas separation taking place in the vortex tube, a series of pressure determinations has been carried out. These, together with data from the literature, permit an evaluation of the magnitude and shape of the tangential velocity profile in the type of tube tested. It is indicated how these results may be interpreted in terms of the strength of the radial and axial velocity components. In a previous publication a number of experimental data were presented, showing the gas-separation ability of the vortex tube. It was concluded that the driving force behind the observed effects is the centrifugal field. In the present investigation, additional information about the conditions prevailing in the type of tube tested has been obtained by measuring static pressures at the wall, along the periphery and elsewhere. More extensive measurements have been made by other authors, and by taking such data into account a fairly complete picture of flow conditions inside the tube has been obtained. Author (ESRO)

N67-27952# Army Tank-Automotive Center, Warren, Mich.
DEPOSITION OF PARTICLES IN A TURBULENT SLOT FLOW
Herbert H. Dobbs and John W. Wiss *In* Army Dept. Proc. of the 1966 Army Sci. Conf., Vol. I 26 Aug. 1966 p 197–210 refs
(See N67-27941 15-34)
(AD-634671)

A theoretical development that applies statistical correlation techniques and uses the geometrically simple Jaklitsch parallel-plate filter is presented for the determination of particles deposited in a turbulent slot flow. It is assumed that the spherical particles are of fixed density as compared to the fluid density, and that particle density is small enough so that the particles behave as individuals and are negligibly influenced by each other. A carefully collimated light beam of high intensity, interrogated at right angles by two collimated seekers of known separation distance, is used. The seekers employ electronic light amplification techniques for particle count and particle transit time information. Data are collected on a digital tape recorder for computer determination of concentration and velocity coefficients. This Dobbs optical anemometer can accurately measure mainstream and boundary layer flow by using small particles as tracers; and turbulence and average velocities are obtained without appreciable instrumentation influence on the flow. M.W.R.

N67-28070# Royal Aircraft Establishment, Farnborough (England).
THE BEHAVIOUR AT INFINITY OF SYMMETRIC SONIC FLOW
D. G. Randall Feb. 1966 31 p refs
(RAE-TR-66030) CFSTI: HC $3.00/MF $0.65

An expansion valid at large distances from the axis of symmetry in the sonic flow past a two-dimensional body is obtained for the disturbance velocity potential. The expansion is a power series in a quantity τ, the coefficients being polynomials in a quantity σ; σ and τ are functions of the usual cartesian coordinates, x and y. Expansions are also obtained for the position and strength of the shock. It is much more difficult to obtain an expansion of this type for the axisymmetric case, although special solutions valid far from the axis can easily be derived. Author

N67-28084# Maryland Univ., College Park. Inst. for Fluid Dynamics and Applied Mathematics.
PHENOMENA SURROUNDING HIGH SPEED FLOW Final Report, 1 Oct. 1962–30 Sep. 1965
J. M. Burgers 30 Jan. 1967 19 p
(Grant AF-AFOSR-141-64)
(AD-648397) CFSTI: HC $3.00/MF $0.65

A review is given of research progress on properties of gases at high temperatures; the effects of these properties in high speed flow; problems of electro- and magneto-gasdynamics and of effects of radiation. TAB

N67-28088# Stanford Univ., Calif. Dept. of Computer Science.
NUMERICAL CALCULATION OF TRANSONIC FLOW PATTERNS
Stefan Bergman, John G. Herriot, and Thomas G. Kurtz 14 Oct. 1966 36 p refs
(Grants NSF GP-4399; AF-AFOSR-1047-66)
(CS-51; AD-648394) CFSTI: HC $3.00/MF $0.65

Procedures are described for computing families of transonic flow patterns of compressible fluid. TAB

N67-28089# University of Southern Calif., Los Angeles. Dept. of Mechanical Engineering.
EFFECT OF HIGH POLYMER ADDITIVES ON DIFFUSER SEPARATION FLOW NOISE
Raymond C. Binder and Ben M. Ishino Jan. 1967 39 p refs
(Contract N60530-1136)
(AD-648088) CFSTI: HC $3.00/MF $0.65

Tests were made with polyox, guar gum and tap water for different flow conditions. The results with tap water for parallel walls showed fair agreement with the results of other investigators. The most significant results were those of overall sound-pressure level SPL for different flow regimes, power spectral density as a function of frequency and visual observations of flow types. In the region of marginal separation the polyox and guar gum additives, in small concentrations, reduced the flow noise below that of tap water; reductions of up to 10 decibels were found. The acoustic energy was primarily in the low frequency region below 200 cycles per second. In the marginal separation region the additives reduced the power spectral density values significantly below that of tap water. For the region of no separation, the SPL for polyox and guar gum was slightly above that for tap water. For the regime of definite separation, polyox and guar gum gave SPL values essentially the same as that of tap water. Author (TAB)

N67-28191# Michigan Univ., Ann Arbor. Dept. of Engineering Mechanics.
ON THE STABILITY OF PARALLEL FLOWS OF VISCOELASTIC LIQUIDS
Dean T. Mook (Ph.D. Thesis) and W. P. Graebel Mar. 1967 70 p refs
(Contract Nonr-1224(49))
(Rept.-06505-2-T; AD-649379) CFSTI: HC $3.00/MF $0.65

A general linear hereditary stress-strain law is used in studying the stability of plane parallel flows of viscoelastic liquids. A stability equation valid for liquids of arbitrary memory is derived by superposing an infinitesimal, two-dimensional, periodic disturbance on the primary flow. It is shown that in the case of liquids with short memory this stability equation reduces to the one given by Walters in 1962. An asymptotic solution to the stability equation is obtained using the method of inner and outer expansions, as presented by Graebel in 1966. Corrections to his expansions are noted, and the results are compared to those obtained by Chan Man Fong and Walters in 1965. The results indicate that the elastic property of the liquid has a destabilizing effect on the flow. In addition the sum of tensor quantities associated with a given particle at various times is discussed. A comparison of the sum obtained by adding corresponding components when they are referred to the same set of material axes and the sum obtained by adding corresponding components when they are referred to the same set of spatial axes is given. Author (TAB)

N67-28196# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
OPTIMUM CONDITIONS OF SUPERSONIC FLOWS WITH OBLIQUE SHOCK WAVES AND SUBSEQUENT HEAT ADDITION [OB USLOVIYAKH OPTIMAL'NOSTI SVERKHZVUKOVYKH TECHENII S KOSYMI SKACHKAMI UPLOTNENIYA I POSLEDUYUSHCHIM TELPLOPODVODOM]
V. I. Penzin 31 Jan. 1967 14 p Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (Kazan), no. 4 1966 p 114–120
(FTD-HT-67-26; TT-67-61392; AD-649418) CFSTI: HC $3.00/MF $0.65

Calculations indicate that the value of sigma in shocks when M sub in is high and there is heat addition to the supersonic flow increase when the pressure of the incident flow decreases, although s increases in this case. Increase of coefficient of total pressure is explained on the basis of the so-called action-reversal condition. Graphs are employed to illustrate the dependence of change of s sub 2 - s sub in and sigma k , sigma sub tau = p sub oz/p sub in on the flow-deviation angle omega in the oblique shock + heat addition system, the dependence of the change of s sub 2 - s sub in on the flow-deviation angle omega for the systems oblique shock + normal shock + heat addition, and oblique shock + heat addition, the dependence of the change of s sub 2 - s sub in on omega for two oblique shocks + normal shock + heat addition and two oblique shocks + heat addition, the

dependence of omega(opt) and M sub 2 on the change of s sub 1 - s sub in caused by the various degree of intensity of heat addition in the oblique shock + heat addition system, and the dependence of omega(opt) on M sub in in the oblique shock + heat addition system. TAB

N67-28210# Societe Nationale d'Etude et de Construction de Moteurs d'Aviation, Suresnes (France). Division Atomique.
STUDY OF THE FLOW DISTRIBUTION IN A TWO-CHANNEL TEST SECTION
10 Feb. 1966 40 p refs /ts Spec. Rept.-24
(Contract EURATOM-061-64-7-TEEF(D))
(EURAEC-1611; EUR-2824) CFSTI: HC $3.00/MF $0.65

The phenomenon of flow distribution between two parallel channels in vortex flow is described. Whatever the flow conditions, there is a transfer of mass between the two channels. The intensity of this transfer depends on the flow velocity conditions. At a given flow velocity, the homogenization length decreases if the flow of gas in the channels increases (this amounts to increasing the true velocities of the fluids). With a very low air flow, the nature of the flow gives very great homogenization lengths. Forces induced by vortex flow, which tend to group the light phase at the center of the channel, are considered. With a high air flow, mixing is very violent. The preparation of a model necessitates a finer analysis of the problem. In particular, it is necessary to know the local conditions at the interface of the channels. Author (NSA)

N67-28213# Centro Informazioni Studi Esperienze, Milan (Italy).
SOME SPACER EFFECTS IN ANNULAR AND CLUSTER GEOMETRIES IN TWO-PHASE ANNULAR-DISPERSED FLOW
P. Alia, L. Cravarolo, A. Hassid, and E. Pedrocchi Nov. 1966 58 p refs Its Topical Rept.-17
(Contract EURATOM-060-61-7-RDI)
(EURAEC-1092; CISE-R-110; EUR-3341) CFSTI: HC $3.00/MF $0.65

The results of experiments in a preliminary investigation into the effect of spacers in annuli and cluster geometries in the vertical upward flow of two-phase (gas + liquid) mixtures in adiabatic conditions are discussed. Investigated were the pressure losses across a spacer in a bundle of rods and film thickness variation across a spacer in an annulus. The experiments were carried out under the following conditions: vertical upward flow (in annular–dispersed regime); gas phase argon and liquid phase water were used; gas flow rate of 8 to 120 g/cm^2 sec; liquid flow rate of 18 to 200 g/cm^2 sec; temperature near 18°C; and pressure up to 22 kg/cm^2. Author (NSA)

N67-28240* Holman (John F.) and Co., Inc., Washington, D. C.
OSCILLATIONS OF A CONDUCTING DROPLET IN A MAGNETIC FIELD [KOLEBANIYA PROVODYASCHEY KAPLI V MAGNITNOM POLE]
A. Gaylitis Washington, NASA, May 1967 16 p refs Transl. into ENGLISH from Magnitn. Gidrodinam., Akad. Nauk Latv. SSR (Riga), no. 2, 1966 p 79–90
(Contract NASw-1495)
(NASA-TT-F-10918) CSCL 20D

The oscillations of a fluid metallic droplet free or immersed in a fluid dielectric in a steady and uniform magnetic field are discussed. Characteristic equations of the oscillations occurring under these conditions and analytical expression for the frequency and damping of the dominant axisymmetrical oscillation are derived. The results of a numerical solution of the characteristic equations are given for lower excitation states of such a droplet in a magnetic field. The asymptotic behavior of the oscillation spectra in strong magnetic fields is investigated. Author

N67-28244# Naval Ordnance Lab., White Oak, Md.
ANALYTICAL STUDY OF NON-EQUILIBRIUM FLOW IN HYPERSONIC NOZZLES USING A SIMPLIFIED MODEL FOR AIR
K. R. Enkenhus 4 Jan. 1967 77 p refs
(NOLTR-66-104; Aerodynamics Res. Rept.-269; AD-649188) CFSTI: HC $3.00/MF $0.65

An analytical method is developed for calculating the one-dimensional flow in hypersonic nozzles of a simplified model of air, which takes into account dissociational and vibrational non-equilibrium effects using the sudden-freezing hypothesis of Bray. The model gas consists of a mixture of oxygen, treated as an ideal dissociating gas, in an inert nitrogen diluent. Author (TAB)

N67-28286* National Aeronautics and Space Administration, Washington, D. C.
BASE PRESSURE STUDIES ON PLANE GAS JETS OF DIFFERENT TEMPERATURES AND VELOCITY [BASISDRUCK-UNTERSUCHUGEN AN EBENEN GASSTRAHLEN UNTERSCHIEDLICHER TEMPERATUREN UND GESCHWINDIGKEITEN]
K. D. Emmenthal Dec. 1966 30 p refs Transl. into ENGLISH from the German
(NASA-TT-F-10452) CSCL 01A

A test apparatus is described which was used to determine the base pressure and to plot the dynamic pressure isobars $P_{dp} = 0$ for different flow parameters involving a transonic hot-gas flow and a supersonic cold-air flow with dividing wall end configuration of the rectangular, circular and boattail type. The tests conducted demonstrate that for given flow conditions maximum underpressure values and zones occur when the dividing wall base is of the rectangular configuration. The boattail configuration should be selected if minimum underpressure values and small underpressure zones are desired. A circular base for the dividing wall leads to relatively large underpressure regions with low underpressure values. Author

N67-28294*# International Information, Inc., Philadelphia, Pa.
SPEED OF SOUND ALONG THE VAPOR-LIQUID PHASE EQUILIBRIUM CURVE. SPEED OF SOUND IN SATURATED WATER VAPOR [SKOROST' ZVUKA NA KRIVOY FAZOVOGO RAVNOVESIYA PAR-ZHIDKOST'. SKOROST' ZVUKA V NASYSHCHENNON VODYANOM PARE]
V. I. Avdonin and I. I. Novikov Washington, NASA, Jun. 1967 7 p refs Transl. into ENGLISH from Zh. Prikl. Mekhan. i Techn. Fiz. (Moscow), no. 1, 1960 p 58–62
(Contract NASw-1499)
(NASA-TT-F-10977) CSCL 20D

The article discusses the unique characteristics of the flow process occurring as a result of phase transformations. Theoretical formulas for the speed of sound in saturated and wet vapor are obtained, based on the assumption that phase transformation accompanies the sound waves. Experiments on the measurement of the speed of sound are described, using the standard wave measurement method. On the basis of experimental values obtained, it is concluded that the Zeiner formula, involving the adiabatic exponent of saturated water vapor, is incorrect. The adiabatic coefficient should be 1.22. Author

N67-28372*# Mechanical Technology, Inc., Latham, N. Y.
EXPERIMENTAL STUDY OF SUPERLAMINAR FLOW BETWEEN NONCONCENTRIC ROTATING CYLINDERS
John Vohr Washington, NASA, Jun. 1967 74 p refs
(Contract NASw-1021)
(NASA-CR-749) CFSTI: HC $3.00/MF $0.65 CSCL 20D

An experimental study was made of superlaminar flow in the annular space between a rotating inner cylinder and a close clearance stationary outer cylinder. The study included measurements of transition speed for onset of vortices at eccentricity

ratios of 0.08, 0.2, 0.35, 0.51, 0.68 and 0.83; measurement of rotational torque in the vortex and turbulent flow regimes over the range of Reynolds numbers from 200 to 4300; and measurements of pressure profiles in the vortex and turbulent flow regimes over the range of Reynolds numbers from 400 to 3200. Critical speed for onset of Taylor vortices was found to increase with eccentricity, this increase being greater at higher clearance ratios than at lower ones. The measurements made of torque and pressure profiles in the Taylor vortex flow regime were compared with theoretical calculations based on an analysis by DiPrima. Visual studies were made of vortex flow and turbulence in the flow between a rotating inner cylinder and an 80° partial arc outer cylinder. The critical speed for onset of Taylor vortices in the flow were found to agree with theoretical prediction by DiPrima to within 25%. Author

N67-28380*# National Aeronautics and Space Administration, Washington, D. C.
TURBULENT MAGNETOHYDRODYNAMIC FLOWS IN PRISMATIC AND CYLINDRICAL PIPES [TURBULENTNYYE MAGNITOGIDRODINAMICHESKIYE TECHENIYA V PRIZMATICHESKIKH I TSILINDRICHESKIKH TRUBAKH]
G. G. Branover, Yu. M. Gel'fgat, and A. B. Tsinober Jun. 1967 25 p refs Transl. into ENGLISH from Magnitn. Gidrodinam. Akad. Nauk Latv. SSR (Riga), no. 3, 1966 p 3–21
(NASA-TT-F-482) CSCL 20I

The state of the art of experimental and semiempirical investigations of turbulent magnetohydrodynamic flows in prismatic and cylindrical pipes is reviewed, followed by an analysis of the transition from laminar to turbulent flow. Several variants of semiempirical theory for two-dimensional flow in the presence of transverse magnetic fields are proposed. A system of simple interpolation relations for plane-parallel flow is given, permitting calculation of drag coefficient, mean velocity profile, and distribution of turbulent friction stresses. Author

N67-28398# California Inst. of Tech., Pasadena. Div. of Engineering and Applied Science.
ON THE SHOCK TRANSITION, THE HYDRAULIC JUMP, AND VORTEX BREAKDOWN
Din-yu Hsieh Mar. 1967 32 p refs
(Contract N00014-67-0094-0009)
(Rept.-85-39; AD-649558) CFSTI: HC $3.00/MF $0.65

The normal shock, hydraulic jump, and vortex breakdown have a common feature: they are all marked by a transition from a supercritical to a subcritical flow state. These phenomena are due to the nonlinearity of the flow, and it is shown that viscosity also plays an essential role. The paper demonstrates explicitly how viscosity enters into these flows. The treatment of normal shock served a starting illustration. Then an equation governing the phenomenon of hydraulic jump is derived with the inclusion of the effect of viscosity. It is explicitly shown that supercritical flow is not stable and has to go through a transition to a conjugate subcritical flow state downstream. Similar treatment is also applied to vortex breakdown with largely similar results. Author (TAB)

N67-28509# Harry Diamond Labs., Washington, D. C.
FLUERICS (FLUID AMPLIFICATION), 23: A BIBLIOGRAPHY
Jan. 1967 179 p refs
(HDL-TR-1338; AD-649629) CFSTI: HC $3.00/MF $0.65

A bibliography is presented of flueric (fluid amplification) literature directly applicable to fluid interaction devices (80 pages). Included are directions for using the bibliography, a glossary of terms, patent and disclosures (38 pages), and other directly applicable contributions to the fluidic technology (51 pages). Author (TAB)

N67-28547# Taggart (Robert), Inc., Fairfax, Va.
THE WALL PRESSURE SPECTRA IN A THICK TURBULENT BOUNDARY LAYER
Matthew Stevenson Apr. 1967 26 p refs
(Contract Nonr-4791(00))
(RT-15101; AD-651130) CFSTI: HC $3.00/MF $0.65

Results are presented of measurements carried out in a quiet flow water tunnel. Boundary layer characteristics are given for a range in maximum flow velocity between 12 and 22 feet/second, and are in the form of the inner semilogarithmic wall law and the velocity defect law. Variation of the displacement thickness with velocity is also shown. From spectrum level curves it is shown that the intensity level falls at a rate of about 10 db/octave with increasing frequency and for any given frequency, the dependence on flow velocity is about 2 db/foot/second over a wide frequency range. Spectral density data are presented in non-dimensional form which are in agreement with previously reported results at least beyond a certain frequency. Below this frequency, an apparent increase in spectral density with increase in flow velocity indicates the presence of low frequency tunnel vibration. Qualitatively, however, the low frequency results show a tendency for the spectral density values to decrease with decreasing frequency. At the higher frequencies, the results indicate clearly the inability of the finite sized transducer to resolve the small wave-length components of the pressure field. Author (TAB)

N67-28581# Atomic Energy Commission Research Establishment, Riso (Denmark).
A REVIEW OF SHOCK WAVE THEORIES (GASDYNAMIC SHOCKS)
C. T. Chang Feb. 1967 55 p refs
(RISO-M-504)

Discussions are presented on the following: (1) fundamental aspects of a compressible flow (examples of the occurrence of shock waves), (2) the formation of a shock wave, (3) general description of a gasdynamic shock, and (4) the structure of a gasdynamic shock. NSA

N67-28617# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
AN EXPERIMENTAL INVESTIGATION OF NONEQUILIBRIUM CORNER EXPANSION FLOWS OF DISSOCIATED OXYGEN
J. E. Drewry May 1967 114 p refs
(Grant AF-AFOSR-67-0554)
(UTIAS-124; AFOSR-67-0554; AD-651141) CFSTI: HC $3.00/MF $0.65

The study consisted of density measurements made with a Mach-Zehnder interferometer and pressure measurements using piezoelectric transducers. In addition, other optical studies (viz., schlieren and shadowgraph) were made to obtain information of a qualitative nature. Two fundamentally different test models were used to generate corner expansion flows in an effort to gain some insight into the nature and extent of boundary layer influence on the final results. The detailed density and pressure results which were obtained indicate a longer relaxation distance than predicted by theoretical calculations based on a partially excited gas model and would appear to favor the predictions of more recent calculations based on a coupled vibration-dissociation model, in lieu of assuming instantaneous vibrational equilibrium. Viscous interaction between the boundary layer and the corner expansion wave tended to modify the experimental results and in some cases was the dominant factor. Author (TAB)

N67-28667# Deutsche Versuchsanstalt fur Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Institut fuer Steuer- und Regeltechnik.
PRELIMINARY EXPERIMENTS ON THE INFLUENCE OF FLEXIBLE WALLS ON BOUNDARY LAYER TURBULENCE
Albrecht Dinkelacker Dec. 1966 81 p refs Sponsored by the Min. of Aviation, London
(DLR-FB-66-78; DVL-570) CFSTI: HC $3.00/MF $0.65

Suitable flexible walls are supposed to have a stabilizing effect on flow transition. This might lead to reduced skin friction

and to reduced flow noise. The aim of the investigation was to learn more about influence of flexible walls on developed turbulence. Water flow through rigid tube sections is compared with flow through flexible tube sections, the mean flow as well as the wall pressure fluctuations being measured. The results depend on many influences and disturbing effects. The nature of some of these influences has been established. With respect to the question of turbulence (or drag) reduction, the experiments are still in a preliminary state and no definite conclusion can be given. Author

N67-28669# Deutsche Versuchsanstalt fur Luft- und Raumfahrt, Munich (West Germany). Institut fuer Physik der Atmosphaere.
KINEMATICS OF LEE-WAVES-FLOW [KINEMATIK DER LEEWELLENSTROEMUNG]
Walter Georgii Mar. 1967 39 p refs In GERMAN; ENGLISH summary
(DLR-FB-67-20; DVL-613) CFSTI: HC $3.00/MF $0.65

The relation between forced lee-waves and the dimension of the obstacle and the resonance with natural waves for the formation of an organized lee-wave current is discussed. With regard to the problem of amplitudes it is stated, that long waves have maximum amplitudes in the high troposphere, while the optimum amplitudes of shorter waves are to be found in lower layers. This leads to reflection of shorter waves at the tropopause. Energy of long waves is being transferred into the stratosphere. For the occurrence of anormal long waves disturbances of the geostrophic equilibrium are responsible. Author

N67-28670 Deutsche Forschungsanstalt für Luft- und Raumfahrt, Brunswick (West Germany). Institut fuer Aerodynamik.
THE LAMINAR WALL-JET WITH SUCTION AND BLOWING [DER LAMINARE WANDSTRAHL MIT ABSAUGUNG UND AUSBLASEN]
J. Steinheuer Dec. 1966 25 p refs In GERMAN; ENGLISH summary
(DLR-FB-66-87; Rept.-66/16)

Similar solutions are presented on the basis of boundary layer theory for the laminar incompressible radial and plane wall jet including suction and blowing. The similarity exponents of the flow are coupled with the distribution of suction or blowing along the wall. In the limiting case of strong blowing the wall jet no longer adheres to the wall and becomes a free jet, while in the case of strong suction it is completely sucked into the wall so that the velocity component parallel to the wall disappears. Author

N67-28671 Deutsche Forschungsanstalt für Luft- und Raumfahrt, Brunswick (West Germany). Institut fuer Strahlantriebe.
FLUID INJECTION INTO A COLD AIR FLOW [FLUESSIGKEITSEINSPRITZUNG IN EINEN KALTLUFTSTROM]
K.-D. Emmenthal and Ch. Saliaris Feb. 1967 31 p refs In GERMAN; ENGLISH summary
(DLR-FB-67-19)

Investigations are described in which a noninflammable fluid was injected against a cold air flow are described. The rate of injection, angle of injection, and Re-number of the air flow were varied. The depth of penetration, jet dispersion, and the starting process of injection were photographically measured and compared with calculated values. Author

N67-28694# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INVESTIGATION OF THE INTERACTION OF A JET WITH SCREENS LOCATED NEAR
O. V. Yakovlevskiy and A. N. Sekundov 23 Dec. 1966 27 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Otd. Tekhn. Nauk: Mekhan i Mashinostr. (Moscow), no. 1, 1964 p 104–114
(FTD-HT-66-370; TT-67-61675; AD-651085) CFSTI: HC $3.00/MF $0.65

Some results are presented of the investigation of flows brought about by the expansion of a turbulent jet close to the surface of a solid body (screen). A problem of this kind arises, for example, in industrial ventilation, in the dividing up of an onflow among sections, in the study of near earth effects which cause a reduction in the lifting force of the jets of aircraft of vertical takeoff and landing. Author (TAB)

N67-28708 Royal Aircraft Establishment, Farnborough (England).
THE SPECTRUM OF TURBULENCE WITH LARGE REYNOLDS NUMBERS [DAS SPEKTRUM DER TURBULENZ BEI GROSSEN REYNOLDSSCHEN ZAHLEN]
C. F. V. Weizsacker Dec. 1966 18 p refs Transl. into ENGLISH from Z. Physik (Berlin), v. 124, 1948 p 614–627
(RAE-LIB-TRANS-1201) CFSTI: HC $3.00

A volume of isotropic turbulence with edge length L_0 is split up into successive partial volumes of edge length L_n. The mean of the physical values is considered over the partial volumes. The condition of equilibrium of the energy dissipation leads to the following rule: the mean value of the relative velocity of a point compared with its neighbouring point separated by L_n is proportional to $L_n^{1/3}$. The transport of turbulence over the distance L_n is thus proportional to $L_n^{4/3}$, in agreement with experimental results. The spectral law of the Fourier analysis of the flow indicates that the energy F (k) dk, which lies between the wave-numbers k and k+dk, is proportional to $k^{-5/3}$. Author

N67-28820 Lockheed Missiles and Space Co., Palo Alto, Calif.
EXPERIMENTAL DETERMINATION OF THE SPECTRUM INDICES OF THE ABSORPTION OF AIR AT 10000–12000°K
A. A. Kon'kov, A. P. Riazin, and V. S. Rudnev [1967] 9 p refs Transl. into ENGLISH from J. Quant. Spectr. Radiative Transfer (London), v. 7, no. 2, 1967 p 345–352

The spectrum composition of radiation, the radiativity, and the absorptivity of air in the 10,000° to 12,000°K temperature range were investigated. The spectrum composition of the radiation was analyzed and the lines and bands in the air spectrum were identified. The absorption coefficients of air were measured in the 3000 to 5000 Å wavelength range at 50 to 60 atm. The experimental results are compared with the computed results of several previous studies and the discrepancies discussed. R.N.A.

N67-28865# Institutt for Atomenergi, Kjeller (Norway).
SLIP RATIOS AND FRICTION FACTORS IN THE BUBBLE FLOW REGIME IN VERTICAL TUBES
Dag Malnes (Licentiatus Technicae Thesis) May 1966 93 p refs
(KR-110) CFSTI: HC $3.00/MF $0.65

Slip ratios in the vertical bubble flow regime have been measured in adiabatic air–water and steam–water flow. The experimental data confirm that the slip ratio in bubble flow may be represented by two terms. The first term is due to the relative velocity between bubbles and water and may be represented by the ratio of rise velocity of single bubbles in still liquids to liquid velocity. The second term is caused by the relative distribution of gas and liquid and is dependent on the initial conditions, as a fully developed two phase flow is largely delayed compared to one phase flow. Void fraction distributions have been measured by means of void needles with standard deviations below 2% void in air–water. Bubble velocity distributions in steam–water have been measured by means of void needles and cross correlation technique. Two-phase friction in air–water has been measured directly by

means of a friction tube. Combined with a pressure drop measurement, the friction tube has been used as a void fraction measuring device as well. Author

N67-28880# Advisory Group for Aerospace Research and Development, Paris (France).
THE PRODUCTION OF INTENSE SHEAR LAYERS BY VORTEX STRETCHING AND CONVECTION
J. T. Stuart May 1965 37 p refs Presented at the AGARD Specialist Meeting, Naples, 10–14 May 1965
(AGARD-514) CFSTI: HC $3.00/MF $0.65

A theoretical model is studied, and this shows how the flow field associated with the boundary layer, which is known to have a streamwise vortex component upstream of transition, can convect the vortex lines into regions where they can be stretched very effectively, so producing strong concentrations of vorticity. Correlation with previous experimental results of Klebanoff and Kovasznay is encouraging and it is suggested, therefore, that this work gives one more link in the understanding of transition processes. Author

N67-28899# Cornell Aeronautical Lab., Inc., Buffalo, N. Y.
INVESTIGATION OF A RAPID-QUENCH SAMPLING PROBE FOR NONEQUILIBRIUM AIR FLOWS Interim Report, 1 Mar. 1965–1 Jul. 1966
F. J. Stoddard and W. S. Watt Arnold AF Sta., Tenn., Arnold Eng. Develop. Center, Mar. 1967 51 p refs
(Contract AF 40(600)-1093)
(AEDC-TR-67-65; AG-1905-A-1; AD-649328) CFSTI: HC $3.00/MF $0.65

Shock tunnel experiments in air are reported which basically were designed to determine the free-stream composition from the gaseous composition of a captured sample. The sample was obtained with an explosively-sealed probe. Because of the rapid cooling of the captured sample by the probe, it was anticipated that the temperature of the sample would be sufficiently low to result in the conversion of the captured NO to NO2. An attempt was made to infer the NO concentration of the free stream by measuring both the NO2 concentration and the resultant O2 deficiency in the sample. It was found that these measurements were limited by several considerations. Among these were chemisorption of NO2 on the interior of the stainless-steel probe, and an apparent diffusive separation caused by the blunt-nosed probe which was used. These effects were eliminated by conditioning the probe through pretest exposure to NO2 and by adding a conical nose piece to the probe. With these changes it was verified that NO was collected, but it was not possible in the present experiments to obtain a quantitative measurement of the NO2 in the sample. This appeared to be the result of water vapor contamination which reacted with free NO2 and O2 to form HNO3. However, significant O2 deficiencies were found which agreed fairly well with those expected. Author (TAB)

N67-28903# Giannini Controls Corp., Malvern, Pa. Astromechanics Research Div.
THE MOMENTUM EQUATION OF A SOLID-FLUID SYSTEM
E. Martinez Mar. 1967 36 p refs
(Contract AF 49(638)-1459)
(AFOSR-67-0657; AD-650399) CFSTI: HC $3.00/MF $0.65

The report examines two-phase flows such as those occurring in fluid devices operating with rocket engine exhausts. The momentum interaction between the two phases of a solid-fluid flow has traditionally been reduced to a body force term in the Navier-Stokes equations with the implication that this interchange is symmetric and does not depend on the characteristics of the mixture, thus failing to describe completely the dependence of the momentum exchange upon such parameters as relative Reynolds number, mass loading ratio, etc. The report redefines the problem in terms of a mathematical model consisting of spherical particles with a statistical size and velocity distribution. A logical procedure is followed by defining rigorously the different characteristic scales in the flow, by taking statistical and space averages of the equation of motion of both phases at each of the scales, and finally by separating the effect of the particles as internal boundary conditions on the fluid from those of the external boundary conditions (e.g. pipe wall). This yields a momentum equation with coefficients which are a function of the mixture parameters. Author (TAB)

13 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

N67-27818 Kakioka Magnetic Observatory (Japan).
REPORT OF OBSERVATION ON GEOMAGNETISM, EARTH-CURRENT AND NIGHT AIRGLOW DURING THE INTERNATIONAL YEARS OF THE QUIET SUN, 1964–1965
1967 230 p

Results of International Years of the Quiet Sun 1964–1965 are presented for observations of geomagnetism, earth current, and night airglow. Geomagnetic and earth-current micropulsations with period from 5 sec to 0.2 sec are given. These micropulsations are pc-1 and the shorter side of pi-1. Observational results of extremely low frequency ELF, 3–30 cps, obtained are tabulated. The values are numbers of ELF bursts, the mean level of ELF signal, average frequencies of the first and second resonance terms, and the ratio of the power of the first term of that of the second. Observations of by a flux-gate magnetometer are given. Distinct cases of such geomagnetic variations as ssc, si, and bay disturbance are illustrated with the simultaneous variations at the regular observatories. Results of scanning photoelectric measurement of radiation intensities of the night airglow are also shown. The wavelengths of the observed radiation are 5577 Å and 6300 Å. In addition to the photoelectric measurement, spectrographic observation of the night airglow was carried out and resulting data are shown. S.P.

N67-27820 National Physical Lab., New Delhi (India). Radio Propagation Unit.
SOLAR AND GEOPHYSICAL DATA. PART 2
Nov. 1966 19 p
(RRC-A137, Pt. 2) CFSTI: HC $3.00/MF $0.65

Solar and geophysical data, of interest for ionospheric studies, are tabulated. Results from four Indian astrophysical observations are presented for: predicted sunspot numbers 2000 Mc/s solar flux, optical observations of solar flares, solar flare effects, magnetic storms, and ionospheric effects of solar flares. S.P.

N67-27860# Academy of Sciences (USSR), Moscow. Soviet Geophysical Committee.
OBSERVATIONS MADE DURING THE FLIGHT OVER WILKES LAND IN THE ANTARCTIC
A. Bugaev, and V. I. Shliakhov *In its* Meteor. Res., No. 11 1966 p 158–169 refs In RUSSIAN; ENGLISH summary (See N67-27856 15-20)

During the Third Soviet Antarctic Expedition in the IGY period a flight was accomplished into the inland regions of the Antarctic in the area Wilkes Land which was never visited before. The relief of that area was studied and actinometric and other kinds of observations were made. This article is dedicated to the results of studying all the materials obtained during this expedition. Author

N67-27866# Academy of Sciences (USSR), Moscow.
VERTICAL WATER MOTIONS IN THE OCEAN: OCEANOLOGY
K. A. Chekotillo 1966 76 p refs
(Rept.-17)

Consideration is given to a study of vertical motion in the whole ocean water column. A quasistationary circulation is examined; inertia and lateral friction effects are regarded as nonessential. Vertical motions in the drift current and in the gradient current are investigated separately. Vertical velocity distribution with depth is especially considered in detail. A thorough description is given of a scheme for practical calculation of vertical motions and of phenomena connected with them; in particular the question is discussed of computation of wind near the sea surface and of its tangential stress. Vertical motions in the real ocean basin are calculated on the basis of the scheme worked out; the Northwestern Pacific is taken as an object for these computations. Good agreement of calculated vertical motions and indirect indications of water upwelling or sinking is pointed out. Author

N67-27868# Academy of Sciences (USSR), Moscow.
MAGNETIC SURVEY OF OCEANS: GEOMAGNETISM
M. M. Ivanov 1966 184 p refs
(Rept.-7)

A short historical review is presented of the development of magnetic observations on oceans, with descriptions of the first Soviet nonmagnetic ship Zarya and the results of magnetic observations on the oceans, carried out in the period of the International Geophysical Year. These results are evaluated from the viewpoint of the general magnetic cartography, of the study of distribution of secular variations of the magnetic field of the Earth on the oceans, and also of the possibilities of their application in the study of the ocean bottom. The paper is meant for geophysicists of wide specialization and, especially, for geophysicists-magnetologists interested in problems of general magnetic cartography, in the study of the secular changes of the magnetic field of the Earth, in problems of interpretation of the results of magnetic observations on extensive areas, and in questions of organization of production of continuous magnetic measurements from moving objects. Author

N67-27869# Academy of Sciences (USSR), Moscow.
OASES IN ANTARCTICA: METEOROLOGY
A. V. Solopov 1967 144 p refs
(Rept.-14)

Consideration is given to research in oases and the dynamic and statistical regularities which permit the study of the atmospheric processes in these regions. Complex study helped reveal the extent of peculiarities and differences in physico-geographical conditions, which distinguish the Antarctic oases from the surrounding ice areas. In fact they are intrazonal intrusions into the vast body of the Antarctic ice continent. The intrazonality is demonstrated in the character of the underlying surface, in the meteorological and radiation regime, in regional peculiarities of atmospheric circulation, and in weather conditions. Due to insignificant albedo the radiation balance in the oases in general for the year is positive and reaches large values. This provides special conditions for the formation of a micro-climate with higher temperatures and small relative humidity of the air in summer, which presents a possibility for an analogy between oases and deserts in middle latitudes. Empirical studies of the Antarctic fronts together with the discovery of other regional peculiarities of atmospheric circulation allow the explanation of an important and characteristic feature of the oases—their location in regions with the least atmospheric precipitation. Author

N67-27881# Academy of Sciences (USSR), Moscow. Soviet Geophysical Committee.
AURORA AND AIRGLOW—ARTICLES, NO. 13
1967 134 p refs In RUSSIAN; ENGLISH summaries
CFSTI: HC$3.00/MF$0.65

CONTENTS:

1. PECULIARITIES OF SPATIAL INHOMOGENEITIES OF THE ATOMIC OXYGEN EMISSION λ 5577 Å IN THE NIGHTGLOW G. A. Nasyrov p 5–9 refs (See N67-27882 15-13)

2. SPATIAL VARIATIONS OF NIGHTGLOW IN THE REGION λ 5893 Å G. A. Nasyrov p 10–12 refs (See N67-27883 15-13)

3. STUDY OF SPACE-TIME PROPERTIES OF THE HYDROXYL EMISSION O. G. Taranova p 13–21 refs (See N67-27884 15-13)

4. HYDROXYL EMISSION AT HIGH LATITUDES N. I. Fedorova p 22–36 refs (See N67-27885 15-13)

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6. SOME RESULTS OF OBSERVATIONS OF HYDROXYL EMISSION OF THE UPPER ATMOSPHERE IN ABASTUMANI L. M. Fishkova and N. M. Martsvaladze p 44–49 refs (See N67-27887 15-13)

7. ON DIURNAL VARIATIONS OF THE HELIUM EMISSION O. G. Taranova p 50–52 refs (See N67-27888 15-13)

8. TWILIGHT EMISSION OF HELIUM AT HIGH LATITUDES N. I. Fedorova p 53–63 refs (See N67-27889 15-13)

9. STATISTICAL PROPERTIES OF THE HELIUM EMISSION N. N. Shefov p 64–68 refs (See N67-27890 15-13)

10. ON VARIATIONS OF H_α EMISSION AND DISTRIBUTION OF HYDROGEN IN THE UPPER ATMOSPHERE AND IN THE GEOCORONA L. M. Fishkova and N. M. Martsvaladze p 69–72 refs (See N67-27891 15-13)

11. PITCH-ANGLE AND ENERGY DISTRIBUTION OF PROTONS IN AURORAE O. L. Vaisberg p 73–82 refs (See N67-27892 15-13)

12. RELATIVE PROPULATION OF THE UPPER VIBRATIONAL LEVELS OF THE BANDS $2PGN_2$ IN AURORA AT DIFFERENT LATITUDES F. K. Shuiskaya p 83–86 refs (See N67-27893 15-13)

13. OBSERVATION OF AURORA ON FEBRUARY 11, 1948, AT STATION ROSCHINO F. K. Shuiskaya p 87–97 refs (See N67-27894 15-13)

14. DISTRIBUTION OF AURORA AND MAGNETIC DISTURBANCES AT HIGH LATITUDES IN CONNECTION WITH THE ASYMMETRIC FORM OF THE MAGNETOSPHERE I. Feldshtein p 98–118 refs (See N67-27895 15-13)

N67-27882# Academy of Sciences (USSR), Moscow. Soviet Geophysical Committee.
PECULIARITIES OF SPATIAL INHOMOGENEITIES OF THE ATOMIC OXYGEN EMISSION λ 5577 Å IN THE NIGHTGLOW
G. A. Nasyrov *In its* Aurora and Airglow 1967 p 5–9 refs
(See N67-27881 15-13)

According to observations in Ashkhabad the characteristic of the patch structure of the green line emission was studied. The most characteristic size of the patches is 60–90 km. The distribution of patch velocities has two maximums: about 75 m/sec and 150 m/sec. This velocity increases with the growth of the K-index. Periodical oscillations are revealed in the intensity of the patches with the period 5.5 and 15.5 min. Author

N67-27883# Academy of Sciences (USSR), Moscow. Soviet Geophysical Committee.
SPATIAL VARIATIONS OF NIGHTGLOW IN THE REGION λ 5893 Å
G. A. Nasyrov *In its* Aurora and Airglow 1967 p 10–12 refs
(See N67-27881 15-13)

The measurements showed the presence of patches in the emission 5893 Å with the intensity about 100 Rayleighs and

about 100×20 km in size. The velocities of movement of patches are about 70 km/sec. The dominating directions of movement are eastern and northern. Author

N67-27884# Academy of Sciences (USSR), Moscow. Soviet Geophysical Committee.
STUDY OF SPACE-TIME PROPERTIES OF THE HYDROXYL EMISSION
O. G. Taranova *In its* Aurora and Airglow 1967 p 13–21 refs (See N67-27881 15-13)

The paper presents observations data of the hydroxyl emission in the spectral region 8000–12,500 Å obtained with a spectrometer. The distribution of rotational temperatures is also obtained for OH bands different vibrational levels and their variations during the night. The spatial patches of the rotational temperature is revealed. According to its variations the velocities of the vertical and horizontal winds on heights of the OH emission are estimated. Author

N67-27885# Academy of Sciences (USSR), Moscow. Soviet Geophysical Committee.
HYDROXYL EMISSION AT HIGH LATITUDES
N. I. Fedorova *In its* Aurora and Airglow 1967 p 22–36 refs (See N67-27881 15-13)

The paper presents results of systematic observations of the hydroxyl emission at station Loparskaya ($\phi = 68°3$ N) during the winter periods in 1960–1963. The intensity of the hydroxyl emission at station Loparskaya does not deviate considerably from the OH intensity at lower latitudes, and the rotation temperature is about 20–40°K higher than in the middle latitudes. During aurora displays the intensity and T_{rot} of the OH bands do not increase. In the winter months the rotation temperature remains almost unchanged from year to year and the decrease of T_{rot} of the OH bands is not observed during lower solar activity. Author

N67-27886 Academy of Sciences (USSR), Moscow. Soviet Geophysical Committee.
SOME PROPERTIES OF THE HYDROXYL EMISSION
N. N. Shefov *In its* Aurora and Airglow 1967 p 37–43 refs (See N67-27881 15-13)

According to materials of observations for many years the variations of intensity and of rotation temperatures of the OH bands with the periods 27 and 29.5 days were revealed. Author

N67-27887# Academy of Sciences (USSR), Moscow. Soviet Geophysical Committee.
SOME RESULTS OF OBSERVATIONS OF HYDROXYL EMISSION OF THE UPPER ATMOSPHERE IN ABASTUMANI
L. M. Fishkova and N. M. Martsvaladze *In its* Aurora and Airglow 1967 p 44–49 refs (See N67-27881 15-13)

Variations of the OH emission were obtained during the solar cycle. The intensity minimum in 1962–1963 was deeper than in 1954–1955. Seasonal variations of the rotational temperature have a larger amplitude for the bands from the upper vibrational levels. The study of the intensity variations of the OH bands with the zenith distance shows that the increase of γ(OH) corresponds to the lowering of the emitting layer. Author

N67-27888# Academy of Sciences (USSR), Moscow. Soviet Geophysical Committee.
ON DIURNAL VARIATIONS OF THE HELIUM EMISSION
O. G. Taranova *In its* Aurora and Airglow 1967 p 50–52 refs (See N67-27881 15-13)

The paper gives the description of the reduction method of spectrophotoelectric observations of the twilight helium emission. Results of measurements are presented. Author

N67-27889 Academy of Sciences (USSR), Moscow. Soviet Geophysical Committee.
TWILIGHT EMISSION OF HELIUM AT HIGH LATITUDES
N. I. Fedorova *In its* Aurora and Airglow 1967 p 53–63 refs (See N67-27881 15-13)

Regular observations of the helium emission λ 10,830 Å at station Loparskaya ($\phi = 68°3, \lambda = 33°1$) during the winter periods in 1960–1963 show that the helium emission is observed only in twilight spectra with the intensity from 200 Rayleighs lower to 3000 Rayleighs. Strong helium emission with the intensity of more 2000 Rayleighs, as a rule, is observed during high magnetic and solar activity, but there is no direct correlation between them. With the decrease of solar activity from 1960 to 1963 the intensity λ 10,830 Å did not change noticeably. During the red aurora of the A type a very intensive helium emission is always observed; while no correlation has been detected with the low forms of aurora. Author

N67-27890 Academy of Sciences (USSR), Moscow. Soviet Geophysical Committee
STATISTICAL PROPERTIES OF THE HELIUM EMISSION
N. N. Shefov *In its* Aurora and Airglow 1967 p 64–68 refs (See N67-27881 15-13)

Statistical treatment of observation data of the helium emission show considerable variations of the ultra-violet radiation of the sun during the solar cycle and with the period of 27 days. A dependence of the electrons fluxes with energies about 25 eV on magnetic activity has been determined. Author

N67-27891# Academy of Sciences (USSR), Moscow. Soviet Geophysical Committee.
ON VARIATIONS OF H_α EMISSION AND DISTRIBUTION OF HYDROGEN IN THE UPPER ATMOSPHERE AND IN THE GEOCORONA
L. M. Fishkova and N. M. Martsvaladze *In its* Aurora and Airglow 1967 p 69–72 refs (See N67-27881 15-13)

The variations of the intensity of the hydrogen emission show the maximum in the period of the minimum of solar activity 1962–1963. The distribution of the hydrogen content at heights from 400 to 1300 km has been calculated. It increases during the period of the minimum of the solar cycle. The concentration of the H_α emission to the ecliptic has not been detected. Author

N67-27892# Academy of Sciences (USSR), Moscow. Soviet Geophysical Committee.
PITCH-ANGLE AND ENERGY DISTRIBUTION OF PROTONS IN AURORAE
O. L. Vaisberg *In its* Aurora and Airglow 1967 p 73–82 refs (See N67-27881 15-13)

On the basis of the profiles of the H_α line, obtained with observations of aurora at different zenith distances, the pitch-angles distribution and the energy spectrum of the entering protons were calculated. The calculated spectrum of the protons corresponds well with the measured spectrum in the solar wind. Author

N67-27893# Academy of Sciences (USSR), Moscow. Soviet Geophysical Committee.
RELATIVE POPULATION OF THE UPPER VIBRATIONAL LEVELS OF THE BANDS $2PGN_2$ IN AURORA AT DIFFERENT LATITUDES
F. K. Shuiskaya *In its* Aurora and Airglow 1967 p 83–86 refs (See N67-27881 15-13)

The observational data of different stations show that the vibrational temperature of the bands $2PGN_2$ in aurora is the same at different latitudes. Author

N67-27894# Academy of Sciences (USSR), Moscow. Soviet Geophysical Committee.

OBSERVATION OF AURORA ON FEBRUARY 11, 1958, AT STATION ROSCHINO

F. K. Shuiskaya *In its* Aurora and Airglow 1967 p 87–97 refs (See N67-27881 15-13)

The paper discusses the results of observations of aurora display on February 11, 1958 (1^h 30^m–4^h 40^mUT) at station Roschino ($\phi \approx 56°$) with all-sky camera and with patrol spectrograph (dispersion ≈ 320 Å/mm, spectral region λ 3900 Å–λ 6600 Å). It has been determined that in the period between 1^h 30^m and 2^h 30^m the spectrum of the aurora contained very intensive forbidden oxygen lines λλ 6364, 6300, 5577 Å and bands $1NGN_2^+$. The total output of energy of the aurora in the visible region of the spectrum at that period reached approximately 2.10^{19} erg/sec. The ratio $I_{6300}/I_{5577}=3.6$. In the period from 4^h till 4^h 40^m, when the magnetic field of the Earth experienced very strong and rapid variations, the brightest emission in the auroral spectrum were the forbidden red oxygen lines. The ratio I_{6300}/I_{5577} at that reached ≈72. The number of ions N_2^+ in the vertical atmospheric column was 3.10^{11} part/cm^2. The maximum intensity was observed in the moments of deep negative bays in the horizontal component of the magnetic field of the Earth. Author

N67-27895# Academy of Sciences (USSR), Moscow. Soviet Geophysical Committee.

DISTRIBUTION OF AURORA AND MAGNETIC DISTURBANCES AT HIGH LATITUDES IN CONNECTION WITH THE ASYMMETRIC FORM OF THE MAGNETOSPHERE

I. Feldshtein *In its* Aurora and Airglow 1967 p 98–118 refs (See N67-27881 15-13)

On the basis of observation materials of the network of all—sky cameras for the periods 1957–1959 and 1963–1965 the distribution is shown of the occurrence of aurora in the zenith depending on latitude and local time for magnetically quiet ($K_p \leq 1$) and magnetically disturbed periods ($K_p \geq 5$). The position of the auroral zone is obtained for the IGY period on the night and day sides of the Earth, and for the IOSY period on the night side with $K_p \leq 1$ and $K_p \geq 5$. The presence of noticeable asymmetry is also shown for magnetically quiet and magnetically disturbed periods. The paper discusses cyclic changes in the occurrence of aurora during the night and latitude distribution of mean diurnal values of aurora occurrence. The results of the statistical analysis of aurora distribution are supplemented by the drafting of synoptic maps of aurora distribution in fixed moments of the Universal Time on 13 and 23 December 1957. Author

N67-27939# Institut d'Aeronomie Spatiale de Belgique, Brussels.

INVESTIGATION OF THE AERONOMY UP TO 50000 KM [INCURSION AERONOMIQUE JUSQU'A 50000 KM]

G. Kockarts [1967] 33 p refs In FRENCH; ENGLISH summary presented at the Soc. Belg. d'Astr. de Meteorol. et de Phys. du Globe Terrest., 17 Dec. 1967 Submitted for publication *Its* Aeronomica Acta A-52-1967

CFSTI: HC $3.00/MF $0.65

The structure of the earth's upper atmosphere is described up to 50,000 km and its composition, energy spectra, particle interactions and temperature are discussed. Author (ESRO)

N67-27947# Army Cold Regions Research and Engineering Lab., Hanover, N. H.

MASSIVE UNDERGROUND ICE IN NORTHERN REGIONS

Jerry Brown *In* Army Dept. Proc. of the 1966 Army Sci. Conf., Vol. I 26 Aug. 1966 p 89–102 refs (See N67-27941 15-34)

(AD-634664)

Formation, distribution, compositional properties, and possible uses of massive underground ice wedges are discussed. These ice wedges contain both organic and inorganic remains that can be used in studying changes in the surrounding tundra environments; and radiocarbon dating of organic residues has established the existence of an ice wedge producing tundra 14,000 years ago at Barrow, Alaska. Progressive warming during this 14,000-year period is suggested by analyses of pollen from both the ice and frozen ground; and bacterial populations suggest that organisms have existed there for long periods of time. A melt water-hoar frost origin for ice wedges is suggested by the low chemical concentrations in wedge melts. Mention is made of the applied aspects of massive underground ice, including the excavation of small tunnels or cavities for storage, instrument platforms, and waste disposal. M.W.R.

N67-27954# Army Engineer Research and Development Labs., Fort Belvoir, Va.

A THEORY OF SHOCK INTERACTIONS FOR MULTIPLE UNDERGROUND NUCLEAR EXPLOSIONS AND THE RESULTING HYPOTHETICAL CRATER VOLUMES

Russell Eaton, III *In* Army Dept. Proc. of the 1966 Army Sci. Conf., Vol. I 26 Aug. 1966 p 231–245 refs (See N67-27941 15-34)

(AD-634674)

A cratering theory for single and multiple nuclear explosions is developed, and cratering curves for single explosions of yields 10 kt were recomputed using computer codes based on the theory. Agreement of the theoretical curve for W=1.2 kt with the data from Jangle U and Teapot Ess shots supports the cratering theory, and the lowering and shifting of the optimum depth of burst to lower scaled depth is supported by many high explosive cratering tests using TNT. Parametric plots computed for simultaneous explosion yields of ≤10 kt indicate maximum crater volumes resulted by varying separation distances and depths of burial for a given total yield. Crater volume is shown to decrease with increasing time lags between explosions. The analytical model for predicting crater volumes is detailed. M.W.R.

N67-27955# Army Natick Labs., Mass.

MILITARY IMPLICATIONS OF SEASONAL ENVIRONMENTAL CHANGE AS REVEALED THROUGH TIME-LAPSE PHOTOGRAPHY

Roland J. Frodigh *In* Army Dept. Proc. of the 1966 Army Sci. Conf., Vol. I 26 Aug. 1966 p 263–277 refs (See N67-27941 15-34)

(AD-634676)

Landscapes for a typical mid-latitude region (New England) were portrayed from the same site at different seasons by color photographic time lapse techniques to show the potential of the camera for study of natural environments and to determine military implications of seasonal environmental changes. Phenomena associated with the "march" of seasons were captured, including the successive changes in vegetation color and density, visibility, trafficability, and drainage that are necessary for camouflage operations and other forms of concealment. Horizontal surface photography does not provide the potential for quantitative analysis inherent in aerial photography; however, ground photography complements aerial coverage to provide a more comprehensive regional analysis of the natural environment. M.W.R.

N67-27958# Army Engineer Geodesy, Intelligence and Mapping Research and Development Agency, Fort Belvoir, Va. Research Inst. for Geodetic Sciences.

A GEOMETRIC SIMULTANEOUS MULTISTATION DETERMINATION, WITH CONSTRAINTS, USING DATA FROM GEODETIC SATELLITES

Lawrence A. Gambino *In* Army Dept. Proc. of the 1966 Army Sci. Conf., Vol. I 26 Aug. 1966 p 303–316 refs (See N67-27941 15-34)

(AD-634679)

A simultaneous, multistation, least squares solution that assumes trajectory points are not mutually independent quantities

is presented for the determination of all points along a trajectory and the three-dimensional coordinates of ground stations. The matrix development is presented in Heuristic fashion, and two geodetic satellite tracking configurations are shown to demonstrate the flexibility of handling electronic data or optical-electronic data with a single multistation program. One example represents the Army's SECOR (Sequential Collation of Range) system, the other the GIMRADA (Geodesy, Intelligence, and Mapping Research and Development Agency) angulateration experiment. M.W.R.

N67-27985# United States Lake Survey, Detroit, Mich.
MODIFICATION OF NEARSHORE CURRENTS BY COASTAL STRUCTURES
James H. Saylor *In* Army Dept. Proc. of the 1966 Army Sci. Conf., Vol. II 26 Aug. 1966 p 287–300 refs (See N67-27971 15-34)
(AD-634637)

Patterns of water circulation along the shores and in the harbors of the Great Lakes have been studied little. The water currents are of direct importance to navigation, water intake placement, and waste disposal, and are contributors to patterns of sediment transport, deposition, and erosion. There is a definite need to be able to predict water currents and their effects before construction of new or modification of existing coastal structures to insure enlightened planning in the rapidly increasing utilization of Great Lakes waters and shorelines. This paper describes and presents the results of water current studies conducted along the shores of Lakes Superior, Michigan, and Erie. The studies have been made at harbor locations with the purpose of establishing current magnitudes and patterns within the harbors and in the adjacent coastal areas, and relating the measured currents with the causative forces. Author

N67-27994# White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.
STRATOSPHERIC TIDAL CIRCULATIONS
Willis L. Webb *In* Army Dept. Proc. of the 1966 Army Sci. Conf., Vol. II 26 Aug. 1966 p 465–479 refs (See N67-27971 15-34)
(AD-634650)

Meteorological rocket network data of synoptic observations on stratospheric circulation over the western portion of the Northern Hemisphere were used to develop a comprehensive description of stratospheric temperature and wind fields in relation to diurnal variations. These tidal type motions significantly alter the general structure of the stratospheric circulation through their thermal and rotational power and are responsible for the stratospheric diurnal heat wave, the equatorial separation of the tidal flow, and the stratospheric tidal jet stream. A graphic summary of the general relationship between stratospheric tidal and general circulation is shown. G.G.

N67-28002*# California Univ., Berkeley. Cosmic Ray Group.
OBSERVATIONS OF THE SEPTEMBER 2, 1966 PCA EVENT: MIDDAY RECOVERY IN ABSORPTION
R. R. Brown and R. Parthasarathy (Alaska Univ.) [1966] 21 p refs
(Contract NAS5-3595; Grants NSF GP-5506; NGR-05-003-096; AF-AFOSR-331-65)
(NASA-CR-84369) CFSTI: HC $3.00/MF $0.65 CSCL 04A

Balloon and riometer observations of the end-phase of a polar cap absorption midday recovery indicate that the increase in absorption was accompanied by corresponding changes in particle flux, with the high energy portion of the spectrum increasing before the lower energy end. Author

N67-28021# Academy of Sciences (USSR), Moscow.
METEOROLOGICAL RESEARCHES
1966 136 p refs In RUSSIAN
(Rept.-12) CFSTI: HC $3.00/MF $0.65

CONTENTS:

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14. ON METEOROLOGICAL CONDITIONS OF THE OCCURRENCE OF NOCTILUCENT CLOUDS Yu. V. Kurilova p 101–105 refs (See N67-28035 15-13)

15. ON THE STUDY OF METEOROLOGICAL AND IONOSPHERIC CONDITIONS OF THE OCCURRENCE OF NOCTILUCENT CLOUDS IN SIBERIA N. P. Fast p 106–110 refs (See N67-28036 15-13)

16. OBSERVATIONS OF NOCTILUCENT CLOUDS IN NOVOSIBIRSK DEPARTMENT OF VAGO IN 1964 S. S. Voinov p 111–112 (See N67-28037 15-13)

17. OBSERVATIONS OF NOCTILUCENT CLOUDS IN GORKY E. G. Demidovich and A. P. Poroshin p 113–114 (See N67-28038 15-13)

N67-28022# Academy of Sciences (USSR), Moscow.
PRESENT STATE OF THE PROBLEM OF NOCTILUCENT CLOUDS
I. A. Khvostikov *In its* Meteorol. Res. 1966 p 5–10 refs In RUSSIAN; ENGLISH summary (See N67-28021 15-13)

The problem is considered of the noctilucent clouds origin, and the new data obtained as a result of the Swedish-American experiments on rocket sounding of these clouds. These experiments confirm the water theory of noctilucent clouds, but now new problems on the mechanisms of the moistening and the temperature regime of the atmosphere in the region of the mesopause have arisen. Some aspects of the dynamics of upper atmosphere in connection with noctilucent clouds investigations: wave movements

in the mesopause, inner gravitational waves and turbulent diffusion in the upper atmosphere are discussed. The possibility of hydrodynamic influence of the tropospheric processes on the state of the atmosphere at the level of the mesopause and namely the formation of noctilucent clouds is considered. In connection with these facts a possible role of the inner gravitational waves is noted. The main peculiarities of noctilucent clouds can be explained from a single point of view. Noctilucent clouds appear in the atmosphere at the place and the time, where and when the temperature of the air turns out to be low enough. Author

N67-28023# Academy of Sciences (USSR), Moscow.
SOME ASPECTS OF STUDY OF NOCTILUCENT CLOUDS
Ch. I. Willman *In its* Meteorol. Res. 1966 p 11–25 refs In RUSSIAN; ENGLISH summary (See N67-28021 15-13)

Considered is the question of climatology of noctilucent clouds (geometry, time-space characteristics, geographical, heliophysical and interplanetary conditions connected with cloud appearance), their physical nature (physical-chemical characteristics and optical properties of particles, their concentration, brightness of noctilucent clouds), the height, kinematic characteristics and dynamics of the noctilucent cloud field. The paper gives the description of the activity of the World Special Geophysical Center on Noctilucent Clouds, organized in 1964 in Tartu. Author

N67-28024# Academy of Sciences (USSR), Moscow.
ON THE CONDITIONS OF VISIBILITY OF NOCTILUCENT CLOUDS
G. V. Fesenkov *In its* Meteorol. Res. 1966 p 26–29 In RUSSIAN; ENGLISH summary (See N67-28021 15-13)

The trajectories of light rays in polar coordinates as well as the corresponding indices of refraction and refraction angles are calculated with the help of electronic machines according to the author's formulas. The results are given in the tables presenting light trajectories within the whole interval of altitudes of the closest approach, namely from 10 to 60 km every 2 km. One can consider that the atmospheric layers within the altitude of 10 km, that is in the region of the troposphere, are in fact opaque to the passing horizontal rays; on the other hand, the rays passing at the altitude of move than 40–50 km do not experience a noticeable refraction or absorption. Author

N67-28025# Academy of Sciences (USSR), Moscow.
ON THE CHOICE OF CONDITIONS OF OBSERVATIONS OF NOCTILUCENT CLOUDS FROM THE EARTH'S SURFACE AND SPACESHIPS
G. V. Rosenberg *In its* Meteorol. Res. 1966 p 30–32 refs In RUSSIAN; ENGLISH summary (See N67-28021 15-13)

Formulas are given for the contrast and brightness of the cloud against the sky background. These formulas are discussed for the conditions corresponding to the site of the observer on the Earth's surface, on the cosmic ship, at the level (by day) of 60–70 km. It is stated that the pearl and other stratospheric clouds, situated lower than 30 km, become visible if they are observed from the cosmic ship against the background of the early dawn. The paper shows that this method is not applicable to noctilucent cloud observations, as the contrast constitudes only fractions of percent. Author

N67-28026# Academy of Sciences (USSR), Moscow.
DETERMINATION OF PARAMETERS OF NOCTILUCENT CLOUDS IN 1964
M. I. Burov *In its* Meteorol. Res. 1966 p 33–46 In RUSSIAN; ENGLISH summary (See N67-28021 15-13)

Presented are the theoretical grounds of stereophotogrammetrical survey of noctilucent clouds. It describes the methods of the survey work in 1964 and gives the results of the processing of the obtained photo. Author

N67-28027# Academy of Sciences (USSR), Moscow.
DETERMINATION OF SPACE COORDINATES OF NOCTILUCENT CLOUDS
M. A. Dirikis, S. V. Evdokimenko, and Yu. L. Franzman *In its* Meteorol. Res. 1966 p 47–51 refs In RUSSIAN; ENGLISH summary (See N67-28021 15-13)

To determine spatial coordinates of noctilucent clouds, measurements of cloud details and reference stars in each photograph were made by a measuring microscope, and the first results of these calculations are given. For noctilucent clouds appearing on the night of June 30, 1961, the following data are presented: number of the pair of photographs and moment of exposure, number of the measured detail, height of detail in km, and geographic latitude and longitude. Another table lists velocity and direction of the movement of these clouds, as well as the horizontal and vertical velocities and azimuth of the direction of movement. The horizontal velocities of some of the measured details are very great—up to 170 m/sec. Their movement is to the south and west. Velocities of the vertical movements are also very different, and in some cases they reach 20 m/sec and more. Author

N67-28028# Academy of Sciences (USSR), Moscow.
DETERMINATION OF THE PROJECTION OF NOCTILUCENT CLOUDS ON THE EARTH'S SURFACE
M. A. Dirikis and E. E. Mookins *In its* Meteorol. Res. 1966 p 52–56 refs In RUSSIAN; ENGLISH summary (See N67-28021 15-13)

For approximate determination of geographic coordinates of noctilucent clouds' projections on the earth's surface using single photographs, it is assumed that the height of the clouds is constant and equal to 82 km. A special table is compiled by means of an electronic computer for the purpose of facilitating calculations. Attempts were made to determine horizontal displacements of some details of noctilucent clouds. Various sources of errors of obtained velocities are discussed. Author

N67-28029# Academy of Sciences (USSR), Moscow.
NATURE OF NOCTILUCENT CLOUDS AND SOME QUESTIONS OF PHOTOCHEMISTRY AND DYNAMICS OF THE EARTH'S ATMOSPHERE
I. A. Khvostikov *In its* Meteorol. Res. 1966 p 57–65 refs In RUSSIAN; ENGLISH summary (See N67-28021 15-13)

Discussed are the presence of ice as the component of noctilucent cloud particles and the low humidity of air in the mesosphere. These difficulties are redoubled by the presence of the intensive photodissociation of H_2O molecules of the sun ultraviolet radiation at the height of 65–90 km. The report indicates to the three possibilities which explain the episodical rise of the conditions, favorable to the humidity precipitation or the condensation centers of noctilucent cloud particles. One of these possibilities is considered at greater length: a formation of additional quantities of H_2O molecules directly in the mesosphere (a sharp increase of the level of the equilibrium concentration of H_2O molecules). One of the mechanisms is connected with the role of corpuscular solar streams in the increase of the hydrogen concentration at the height of 100 km, mentioned in 1952. This mechanism is considered with the account of the modern data on solar wind (solar rain). The other mechanism is connected with the influence of the dynamic factors which have not been yet taken into consideration by the theory. Author

N67-28030# Academy of Science (USSR), Moscow.
MEASUREMENT OF HUMIDITY IN THE UPPER ATMOSPHERE
Ye. Badinov, S. D. Andreev, and U. B. Lipatov *In its* Meteorol. Res. 1966 p 66–79 refs In RUSSIAN; ENGLISH summary (See N67-28021 15-13)

A critical summary is presented on the measurements of humidity in the upper atmosphere. Airborne investigations were

made with the condensation hydrometer, and data are given for spectral observations over England, and measurements in the USSR. Automatic balloon solar spectrophotometers registered the solar spectrum within the wide region of 0.4 to 13 microns. The spectra up to 25–28 km were recorded. The integral content of water vapor above different levels was defined by the bands 0.94; 1.13; 1.39; 1.87, and 6.3 microns. Above the level of 28 km on October 23, about 1 micron of water vapor was found; other escents confirmed a small content of water vapor in the stratosphere. It was concluded that humidity increases with height and is caused by the pollution brought in by the balloon and other equipment. Analysis of all recent measurement results indicates that the concept of a humid stratosphere is groundless. Author

N67-28031# Academy of Sciences (USSR), Moscow.
ON THE INTERPRETATION OF THE RESULTS OF ROCKET SOUNDING OF NOCTILUCENT CLOUDS
V. V. Mikhnevich *In its* Meteorol. Res. 1966 p 80–83 refs In RUSSIAN; ENGLISH summary (See N67-28021 15-13)

Considered are the results of the interesting Swedish-American experiments on the rocket sounding of noctilucent clouds. There is not always a conformity between the data of detectors, mounted on the rapidly flying rocket, and the true properties of the free atmosphere. A greater number of particles on the day of the launch to the noctilucent clouds can be explained by the fact that dry dust specks flow around the rocket detector together with the onrunning air stream, while the dust specks with ice crusts, being of a larger mass, are not so easily carried away by the on-running stream. The increase of meteor activity from 7 to 11 of August should be taken into account. The considered effect of the flow by the on-running stream around the detector can also explain the increase of a relative content of small dust specks during the launch to the cloud. Author

N67-28032# Academy of Sciences (USSR), Moscow.
TEMPERATURE OF ATMOSPHERE IN THE REGION OF MESOPAUSE AND DISTRIBUTION OF NOCTILUCENT CLOUDS
V. V. Mikhnevich *In its* Meteorol. Res. 1966 p 84–87 refs In RUSSIAN; ENGLISH summary (See N67-28021 15-13)

Considered are the seasonal and latitudinal dependences of temperature to investigate the correlation between temperature mesopause and noctilucent cloud distribution. The existence of the full correlation of such a type is established. This fact confirms the great role of temperature in noctilucent cloud formation. Author

N67-28033# Academy of Sciences (USSR), Moscow.
DYNAMICS OF ATMOSPHERE AND NOCTILUCENT CLOUDS
B. A. Mirton *In its* Meteorol. Res. 1966 p 88–91 refs In RUSSIAN; ENGLISH summary (See N67-28021 15-13)

Considered are the existing data on the dynamic processes in the upper atmosphere. The defining process for the atmosphere mixing at the altitudes of 60–100 km is the process of an intensive large scaled turbulent mixing. It is stated that the dust layer in the noctilucent cloud zone cannot be stable. The turbulent mixing hinders the formation of a narrow stable dust layer at the mesopause level and promotes the formation of a cloud layer of ice origin. Author

N67-28034# Academy of Sciences (USSR), Moscow.
MORPHOLOGICAL STUDIES OF NOCTILUCENT CLOUDS
N. I. Grishin *In its* Meteorol. Res. 1966 p 92–100 refs In RUSSIAN; ENGLISH summary (See N67-28021 15-13)

Morphological investigations constitute an important part of the problem of noctilucent clouds. Geometrical conditions of noctilucent cloud observations from the surface of the Earth and from different levels of the atmosphere are shown. The photos of the crape, bands, waves and whirls of noctilucent clouds are seen as well as an example of perspective distortion and mutual screening of wave formations when observed at a small angle (15°). Further morphological investigations should be developed to determine the true physical nature of each type of structural formation and the thermodynamical conditions of their origin. Author

N67-28035# Academy of Sciences (USSR), Moscow.
ON METEOROLOGICAL CONDITIONS OF THE OCCURRENCE OF NOCTILUCENT CLOUDS
Yu. Kurilova *In its* Meteorol. Res. 1966 p 101–105 refs In RUSSIAN; ENGLISH summary (See N67-28021 15-13)

Results are presented of a detailed analysis of the synoptic maps in the periods of the noctilucent cloud appearance in 1963–1964 over Western Siberia. The conclusion on the connection of noctilucent clouds with anticyclonic conditions, is confirmed. The explanation of this connection, based on the account of the appearance in the troposphere and the propagation upward of the inner gravitational waves is suggested. The formation of these waves is favored by the presence of the anticyclone. An estimation is given of the possible energetic contribution from gravitational waves into the upper layers: the energy streams appear significant. Compare the range of gravitation wave frequencies with the wave characteristics in noctilucent clouds with the account of the data on the general spectrum of meteorological fields. Author

N67-28036# Academy of Sciences (USSR), Moscow.
ON THE STUDY OF METEOROLOGICAL AND IONOSPHERIC CONDITIONS OF THE OCCURRENCE OF NOCTILUCENT CLOUDS IN SIBERIA
N. P. Fast *In its* Meteorol. Res. 1966 p 106–110 refs In RUSSIAN; ENGLISH summary (See N67-28021 15-13)

Considered is the question of the connection of noctilucent clouds with the synoptical conditions. The author could not draw any regularity in synoptical conditions prior to the noctilucent cloud appearance. A statistical estimation is given of the hypothesis about the existence of the connection between the noctilucent cloud appearance and the height of the sporadic ionospheric layer E. There are no sufficient factual data to correct the hypothesis. Author

N67-28037# Academy of Sciences (USSR), Moscow.
OBSERVATIONS OF NOCTILUCENT CLOUDS IN NOVOSIBIRSK DEPARTMENT OF VAGO IN 1964
S. S. Voinov *In its* Meteorol. Res. 1966 p 111–112 In RUSSIAN; ENGLISH summary (See N67-28021 15-13)

Results are presented of the noctilucent cloud observations, carried out in Novosibirsk by the Youth Section of the Novosibirsk Department of the All-Union Astronomo-Geodetic Society. Author

N67-28038# Academy of Sciences (USSR), Moscow.
OBSERVATIONS OF NOCTILUCENT CLOUDS IN GORKY
E. G. Demidovich and A. P. Poroshin *In its* Meteorol. Res. 1966 p 113–114 In RUSSIAN; ENGLISH summary (See N67-28021 15-13)

Results are presented of the noctilucent cloud patrol observations, made by the Gorky Department of the All-Unice Astronomo-Geodesic Society in 1964. Author

N67-28072# Academy of Sciences (USSR), Moscow. Soviet Geophysical Committee.
LATITUDE VARIATIONS AND POLAR MOTIONS—ARTICLES. NO. 3
1965 94 p refs In RUSSIAN; ENGLISH summaries
CFSTI: HC $3.00/MF $0.65

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1. COORDINATES OF THE EARTH'S POLE FROM PROVISIONAL DATA OF LATITUDE OBSERVATIONS MADE DURING THE IGY A. A. Korsun p 5–14 refs (See N67-28073 15-13)

2. THE PROCESS OF SMOOTHING AND ESTIMATION OF THE ACCURACY OF LATITUDE OBSERVATIONS I. I. Glagoleva and E. P. Fedorov p 15-33 refs (See N67-28074 15-13)

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7. DISPLACEMENT OF THE FOCAL PLANE OF THE DANJON ASTROLABE DUE TO TEMPERATURE VARIATION A. V. Gozhy and A. A. Slavinskaja p 73–76 refs (See N67-28079 15-13)

8. ON THE VARIATION OF THE SEASONAL TERM IN THE RATE OF EARTH'S ROTATION IN 1960 AND 1961 N. N. Pavlov and G. V. Staritsyn p 77–80 refs (See N67-28080 15-13)

N67-28073# Academy of Sciences (USSR), Moscow. Soviet Geophysical Committee.

COORDINATES OF THE EARTH'S POLE FROM PROVISIONAL DATA OF LATITUDE OBSERVATIONS MADE DURING THE IGY

A. A. Korsun *In its* Latitude Variations and Polar Motions 1965 p 5–14 refs (See N67-28072 15-13)

Polar coordinates were computed from observations made with 6 photographic zenith tubes, 14 zenith telescopes, 3 Danjon astrolabes and 1 transit instrument from 1957.5 to 1960.0. Values of x and y may be regarded as the coordinates of the center of a confidence ellipse, whose semiaxes are 0".030 and 0".027. The assertion that the pole lies within this ellipse will be true, on the average, in 97 cases out of 100. Author

N67-28074# Academy of Sciences (USSR), Moscow. Soviet Geophysical Committee.

THE PROCESS OF SMOOTHING AND ESTIMATION OF THE ACCURACY OF LATITUDE OBSERVATIONS

I. I. Glagoleva and E. P. Fedorov *In its* Latitude Variations and Polar Motions 1965 p 15–33 refs (See N67-28072 15-13)

The moving-average process proposed applied to smoothing observational latitude curves. This enables the standard error of initial data to be computed from deviations of the means for certain intervals of time from the smoothed curve, provided the observational errors of individual latitudes are independent random values. Then allowance has been made for the fact that usually the weights of the means are different, and the Whittaker's method has been modified so as to make it applicable to this case. Author

N67-28075# Academy of Sciences (USSR), Moscow. Soviet Geophysical Committee.

VARIATIONS OF LATITUDES DURING THE IGY: SMOOTHING OF THE INITIAL DATA AND PRELIMINARY ESTIMATION OF THEIR ACCURACY

I. I. Glagoleva *In its* Latitude Variations and Polar Motions 1965 p 34–45 refs (See N67-28072 15-13)

The method of smoothing described is applied to all available series of latitude observations during the IGY. To estimate the accuracy of the initial data the process described was used. Results are tabulated. Author

N67-28076# Academy of Sciences (USSR), Moscow. Soviet Geophysical Committee.

RESULTS OF CONCURRENT OBSERVATION WITH TWO ZENITH TELESCOPES AT KITAB

A. M. Kalmykov *In its* Latitude Variations and Polar Motions 1965 p 46–47 ref (See N67-28072 15-13)

A new comparison of latitude observations made with two zenith telescopes at Kitab confirms that the annual nonpolar terms are different for these instruments. Author

N67-28077# Academy of Sciences (USSR), Moscow. Soviet Geophysical Committee.

LATITUDE OBSERVATIONS AT THE ULUG BEG STATION

D. I. Kravtsev *In its* Latitude Variations and Polar Motions 1965 p 48–49 (See N67-28072 15-13)

Latitude variation is derived from the observation made at Kitab with the Bamberg zenith telescope from 1957.5 to 1961.0. Author

N67-28078# Academy of Sciences (USSR), Moscow. Soviet Geophysical Committee.

THE EFFECT OF INCLINATIONS OF AIR STRATA OF EQUAL DENSITY ON LATITUDE AND TIME DETERMINATION.

G. S. Tuterev *In its* Latitude Variations and Polar Motions 1965 p 50–72 refs (See N67-28072 15-13)

The paper deals with anomalous refraction due to inclination of air strata in the troposphere. Correlation is revealed between the computed effect of refraction and the systematic errors of latitude and time observations at Washington, Herstmonceaux, Pulkovo and Tokyo. The anomalous refraction can partly account for annual terms and so should be allowed for the reduction of the most precise latitude and time determinations. Author

N67-28079# Academy of Sciences (USSR), Moscow. Soviet Geophysical Committee.

DISPLACEMENT OF THE FOCAL PLANE OF THE DANJON ASTROLABE DUE TO TEMPERATURE VARIATION

A. V. Gozhy and A. A. Slavinskaja *In its* Latitude Variations and Polar Motions 1965 p 73–76 refs (See N67-28072 15-13)

Effect of temperature on the position of the focal plane of the Danjon astrolabe installed at the Poltava Observatory was investigated. They derived from 845 determinations made at temperature t ranging from −17°.3 to +25°.4 C the following formula $\Delta_r = 0''.04531(16°.2 - t)$ where Δ_r is a correction for the displacement of the focal plane. Author

N67-28080# Academy of Sciences (USSR), Moscow. Soviet Geophysical Committee.

ON THE VARIATION OF THE SEASONAL TERM IN THE RATE OF EARTH'S ROTATION IN 1960 AND 1961

N. N. Pavlov and G. V. Staritsyn *In its* Latitude Variations and Polar Motions 1965 p 77–80 refs (See N67-28072 15-13)

The object of this investigation is to see if some irregularities of the seasonal term in the rate of Earth's rotation are due to meteorological anomalies. The initial data used were those taken as time observations with the photoelectric transit instrument at Pulkovo. Comparison of these data with atomic time indicates that some peculiarities of the annual term may be ascribed to an early coming of spring on the northern part of the European Asiatic continent in 1959 and 1961. Author

N67-28082# Institute of Modern Languages, Inc., Washington, D. C. Translation and Interpretation Div.
ON THE RELIABILITY OF PHOTOGRAMMETRIC SURVEYS IN FOREST BELT AREAS [O POUZDANOSTI FOTOGRAMETRIJSKIH SLOJNICA SUMSKIH PODRUCJA]
Sdenko Zagreb Tomasegovic Mar. 1967 13 p Transl. into ENGLISH from Geodetski (Belgrade), No. 10–12, 1965 p 259–264
(Contract DA-44-009-AMC-1563(T))
(T-1895-67; TT-67-61338; AD-648989) CFSTI: HC $3.00/MF $0.65

A review is presented of research on the topics of (1) the accuracy of photogrammetric plotting in a forest, (2) the reliability of photogrammetric plotting in forest areas. TAB

N67-28098# Army Cold Regions Research and Engineering Lab., Hanover, N. H.
CREEP OF SNOW AND ICE
Malcolm Mellor and James H. Smith Dec. 1966 20 p refs
(CRREL-RR-220; AD-649367) CFSTI: HC $3.00/MF $0.65

Constant load creep tests in uniaxial unconfined compression were performed on samples of sintered snow and bubbly polycrystalline ice. Nominal axial stresses were in the range 0.1 to 1.0 kgf/sq cm for snow, and 0.5 to 20 kgf/sq cm for ice. The range of temperatures investigated was from -0.5 to -34.5C. Assuming creep to follow the Arrhenius relation, values of apparent activation energy for secondary creep under a nominal axial stress of 0.5 kgf/sq cm varied from 10.7 kcal/mole for ice of density 0.83 g/cu cm to 17.8 kcal/mole for snow of density 0.44 g/cu cm. The dependence of strain rate epsilon on stress sigma for polycrystalline ice subjected to stresses in the range 0.5 to 20 kgf/sq cm at temperatures of -4 and -10C could best be described by a relation of the form epsilon = C sub 1 sigma + C sub 2 sigma to the 3.5 power where C sub 1 and C sub 2 are constants for a given ice type. It is suggested that the creep of polycrystalline ice depends on at least two distinct mechanisms in the stress range studied. If each mechanism has its own characteristic activation energy, the apparent activation energy measured in creep experiments may well vary with stress level. In snow subjected to a given nominal stress, such an effect should be reflected in variation of apparent activation energy with bulk density. Author (TAB)

N67-28205# Nuclear Science and Engineering Corp., Pittsburgh, Pa.
I^{129}: A NEW ATMOSPHERIC TRACER
B. Keisch, R. C. Koch, A. S. Levine, J. Roesmer, and W. S. Winnowski Aug. 1965 99 p refs
(Contract AT(30-1)-3201)
(NYO-3201-1; NSEC-120) CFSTI: HC $3.00/MF $0.65

The requirements for tracers of atmospheric motions are reviewed, particularly with respect to their utility over distances greater than ten miles. The development of tracers incorporating the long-lived nuclide ^{129}I is discussed. The two ^{129}I-labeled tracers, diiodofluorescein and trifluoromethyl iodide, were developed for use as an aerosol and a gaseous tracer, respectively. Detailed descriptions of the methodology for the synthesis, dissemination, collection, and analysis of these tracers are given. The use of ^{129}I as the tracer can result in the extremely high sensitivity and low background required for tracers useful over long distances. High sensitivity is achieved by using specially developed neutron-activation analysis methods. Low background concentrations result from the fact that there is virtually no naturally occurring ^{129}I. The results of a series of field tests of these tracers showed that the method is sound. Results essentially in agreement with theoretical predictions, were obtained to distances of 64 kilometers for the aerosol tracer. However, the results for the gaseous tracer were inconclusive due to the inadvertent use of charcoal contaminated with fission-product ^{129}I as the gas sampling media. Calculations, based on assumptions of somewhat improved background levels and reasonable increases in the quantities of ^{129}I released, show that the ^{129}I tracer method can be effective over ranges up to 800 kilometers. Author (NSA)

N67-28248# California Univ., Los Angeles. Dept. of Meteorology.
INVESTIGATIONS OF THE POLARIZATION OF LIGHT REFLECTED BY NATURAL SURFACES
Hsi-shu Chen, C. R. Nagaraja Rao, and Z. Sekera Jan. 1967 104 p refs
(Contract AF 19(628)-3850)
(SR-2; AFCRL-67-0089; AD-649505) CFSTI: HC $3.00/MF $0.65

The polarization features of light reflected by soil, desert sand, white sand and water under different conditions of illumination with natural (unpolarized) and polarized light were investigated in three narrow spectral intervals (band width approximately 150A) centered on wavelengths 3975, 5000 and 6050A. A simple rotating-analyzer type photoelectric reflectometer was used in the measurements. The data was acquired in computer compatible format to facilitate Fourier analysis of the photosignal. The degree of polarization and relative intensity variations were determined from a knowledge of the Fourier coefficients. The polarization of light reflected by soil, desert sand and white sand exhibits pronounced wavelength dependence. There is overall similarity in the behavior of soil and desert sand. White sand shows a strong tendency to behave like an ideal diffuser (Lambert surface). The hypothesis of scattering of light by an optically rough, locally smooth surface has to be invoked to explain the reflection characteristics of an apparently smooth surface of water. Author (TAB)

N67-28324# Stanford Univ., Calif. Radioscience Lab.
A STUDY OF THE MECHANISMS OF WHISTLER PROPAGATION AND VLF EMISSION GENERATION Final Report, Oct. 1, 1965–Sep. 30, 1966
R. A. Helliwell Jan. 1967 15 p refs
(Grant AF-AFOSR-783-66)
(AFOSR-67-0461; AD-648675) CFSTI: HC $3.00/MF $0.65

The review is organized under three main topics: (1) Properties of the magnetosphere, (2) Propagation and Detection Studies, and (3) Wave-Particle Interactions. Using whistlers, plasma drift motion was detected in the magnetosphere for the first time, and this has been interpreted in terms of a magnetospheric electric field with a westward component of about 0.3 mv/m at an equatorial distance of 4 earth radii. The upper cutoff frequency of whistlers was found to be remarkably close to 1/2 the minimum gyrofrequency along the field-line path, providing strong evidence in support of the duct cutoff theory of R. L. Smith. A sudden cutoff of whistler-mode signals was found at latitudes above the plasmapause. Research on wave-particle interaction theory has shown that previous theories have neglected the transient effects which are of importance in the interaction of whistlers with the medium. These results suggest that presently published theory on wave-particle interactions may be inapplicable to much of the whistler and discrete vlf emission phenomena. Author (TAB)

N67-28366*# Electro-Optical Systems, Inc., Pasadena, Calif.
STUDY TO DEVELOP A TECHNIQUE FOR MEASUREMENT OF HIGH ALTITUDE OZONE PARAMETERS Interim Report
J. A. Duardo 15 May 1967 163 p refs
(Contract NAS12-137)
(NASA-CR-80022; EOS-7087-IR-1) CSCL 04A

Consideration is given to the spectroscopy of ozone, the measurement of its atmospheric concentrations by optical means, its role in atmospheric dynamics, and its potential use as a tracer for atmospheric winds. The role that ozone plays in meteorological processes is discussed, emphasizing atmospheric wind–ozone relations, and an attempt was made to establish the value of continuous monitoring of the worldwide distribution of ozone to trace large scale air mass motions. Information obtained on ozone spectroscopy and atmospheric measurement, which is pertinent to

the analyses in this paper, is summarized. Advanced conceptual methods of ozone measurements from orbiting satellites are also discussed, including passive techniques and active techniques with optical probes. Two ozone measuring techniques were selected as the most promising for use in conjunction with an orbiting spacecraft: a passive technique using differential attenuation of solar radiation and the active probe method utilizing Raman laser radiation. These two methods are discussed in detail and their advantages are pointed out. An extensive bibliography is also included. L.E.W.

N67-28368*# Cutler-Hammer, Inc., Deer Park, N. Y.
INVESTIGATION OF PLANETARY IONOSPHERES
B. Mohr, Z. Poznanski, D. Luganski, G. Kraft, and S. H. Gross Washington, NASA, May 1967 205 p refs
(Contract NAS5-9108)
(NASA-CR-689) CFSTI: HC $3.00 CSCL 03A

The feasibility of using radio-sounding techniques to investigate the ionospheric properties of the planets was studied. Principal concern was with overall systems evaluation, signal processing, and transmitter design for an advanced long-range sounder system. Sounding ranges of interest were from nearby to 40,000 km. Application of the new sounder system was made to typical planetary missions such as the Voyager–Mars Orbiter and the Mariner–Mars flyby spacecrafts. The signal-processing design study was based on a previous program, which concluded that digitized pulse-compression and integration techniques were the most desirable methods to be used in advancing the state of the art of ionospheric sounding. Investigations of these techniques and their applications to typical planetary sounding systems resulted in detailed examinations of circuits, components, and characteristics. The design effort was direct toward providing a sounding capability from extremely long ranges, as well as from nearby, over a wide band of frequencies. The transmitter design consisted mainly of breadboarding efforts to realize a wide-band untuned system entirely of solid-state components. The task also included a study of the design of matching networks for dipole antennas. Author

N67-28392# Autonetics, Anaheim, Calif.
TERRAIN EIGENVECTOR DYAD ANALYSIS Final Report, 27 Jun. 1966–27 Jan. 1967
Michael A. Holly 27 Jan. 1967 75 p refs
(Contract DA-44-009-AMC-1696(X))
(C-6-3231/030; AD-649347) CFSTI: HC $3.00/MF $0.65

In the study a surface-fitting algorithm, the dyad-spline method, was applied to typical terrain elevation data in order to evaluate the methods worth for incorporation in an All-Weather Mapping System. Various combinations of data spacing and representative amounts of simulated measurement noise were considered. In general the algorithm proved to be relatively impervious to measurement noise, and was capable of reproducing the true terrain with good fidelity. In a typical case, 5-mile spacing was employed for flight-line data, with nine rows of intermediate data per flight line. Normal noise was added to all data, with sigma = 10 ft along the flight lines, and with sigma = 50 ft along the intermediate lines. Under these conditions the dyad-spline method was able to reproduce the original terrain at interpolated points to within 105.3 ft RMS. The application of a weighting matrix technique to the variable quality data was also examined, and it was found that the minimum error was obtained when all data were weighted equally. Author (TAB)

N67-28417# Brookhaven National Lab., Upton, N. Y.
GEOLOGIC DATING BY ELECTRON SPIN RESONANCE
E. J. Zeller, P. W. Levy, and P. L. Mattern Feb. 1967 13 p refs
Presented at the IAEA Symp. On Radioact. Dating and Methods of Low-Level Counting, Monaco, France, 2–10 Mar. 1967
Submitted for publication
(Contract AT(30-2)-GEN-16)
(BNL-11080; CONF-670309-1) CFSTI: HC $3.00/MF $0.65

A method of dating geologic samples is described which is based on a measurement, by electron spin resonance techniques, of the trapped charge induced in minerals by their radioactive impurities. The origin of the traps in minerals, charge creating ionization processes, and the factors controlling the retention of trapped charge are briefly reviewed. The principles of electron spin resonance (ESR) measurements are described with particular emphasis on the detection of ESR signals in minerals and the measurement of trapped charge. This method has been applied to the dating of apatite crystals from Durango, Mexico. These crystals exhibit two ESR absorption peaks which increase in intensity when the crystals are irradiated with gamma rays. The pre-irradiation ESR signals, and the change in these signals induced by known gamma-ray doses are used to determine the total dose acquired during geologic time. The dose imparted to these crystals annually was computed from their radioactive impurity content, determined by scintillation counting. The age computed from the geologic dose and the annual dose rate is 2 to 4×10^6 years. Cursory annealing measurements indicate that the apatite ESR signals are associated with traps that will retain charges in excess of 4×10^6 years. Although the apatite samples have not been independently dated, the stratigraphy of the Durango region puts an upper limit on their age as approximately 5×10^7 years. Author (NSA)

N67-28504# Texas Univ., Austin. Electrical Engineering Research Lab.
MAGNETOSPHERIC DUCTING OF ELECTROMAGNETIC WAVES EXCITED BY A LINE SOURCE DISTRIBUTION
Charles E. Laird, Jr. and Francis X. Bostick, Jr. 1 Apr. 1967 51 p refs
(Contract Nonr-375(14))
(Rept.-145; AD-649378) CFSTI: HC $3.00/MF $0.65

An atomospheric model was used to study the propagation of energy from an electromagnetic source located in the earth's upper atmosphere. An infinite line current source was used with a two-dimensional earth and atmosphere for this study. The model consisted of n isotropic layers with a real value of conductivity, permittivity and permeability in each layer. The earth's magnetic field was omitted from the model. A system of iterative computational matrices was used for numerical evaluation of an 11-layer model where attenuation and phase velocity profiles were stratified for the layer parameters. Curves of the magnitude of the tangential component of magnetic field intensity at the earth's surface are presented as a function of source frequency at a constant distance along the earth's surface from the source, and as a function of distance along the surface from the source at a constant source frequency. The results indicate that ducting or guiding of the energy occurs over a frequency range, and show a large peak of magnetic field intensity on the earth's surface at about 0.3 cycles per second. Author (TAB)

N67-28558# Brown Univ., Providence, R. I. Dept. of Physics.
RESEARCH ON FLUID DYNAMICAL MODELS OF THE LARGE SCALE ATMOSPHERIC CIRCULATIONS Final Report, 1 Jan. 1965–31 Mar. 1967
Howard A. Snyder Jan. 1966 94 p refs
(Contract AF 19(628)-4783)
(AFCRL-67-0166; AD-651046) CFSTI: HC $3.00/MF $0.65

The report describes three investigations in the field of hydrodynamic stability. The purpose of the experiments is to study the mechanisms which operate in the large scale circulation of the atmosphere. It is generally assumed that secondary flows in the form of baroclinic waves are the primary cause of the propagation of atmospheric disturbances. These waves must be treated as finite amplitude disturbances and accordingly the use of non-linear analysis is required to predict the properties of the waves. Past attempts at calculating finite amplitude secondary flows have not been very successful but recently Stuart and Watson have developed a method which has proved to be reliable. The computations for the case of isothermal flow between concentric rotating cylinders has

been carried out using this method and one of the investigations described here is an experimental verification of the theoretical predictions. It is also shown that a logical extension of the theory requires the existence of jets and shock-like structure in the flow field and these features are demonstrated experimentally. In a second investigation it is shown strongly affected by horizontal shear. Horizontal shear has a strong stabilizing effect on baroclinic waves. The third set of experiments demonstrates the strong stabilizing action of high polymer non-Newtonian fluids. Author (TAB)

N67-28561# Defence Research Board, Ottawa (Ontario).
SOME QUESTIONS IN THE HISTORY OF THE GEOMAGNETIC FIELD AT THE END OF THE MIDDLE PALEOZOIC AND IN THE UPPER PALEOZOIC
V. P. Aparin and A. Ya. Vlasov Oct. 1966 10 p ref Transl. into ENGLISH from the book "Nastoyashcheye i Proshloye Magnitnogo Polia Zemli" Moscow, "Nauka" Press 1965 p 213–220
(T-461-R; AD-649522) CFSTI: HC $3.00/MF $0.65

From paleomagnetic work on the Russian and North American Platforms and their mountainous borderlands, in the second half of the Paleozoic Era, two regular characteristics in the development of the geomagnetic field: long duration of the zones of reverse magnetization; close grouping of the paleomagnetic poles of each epoch for each of the different continents. The considerable durations of the reversely magnetized zones make it possible, on the basis of stratigraphic interconnections, to effect a comparison and alignment of (magnetic) zones on an inter-regional (supraregional) scale; also to tie in the paleomagnetic pole determinations with definite zones, and thus exclude, in comparing poles, error due to differing ages of the rocks studied. These facts, together with the clear separation of the Recent and Paleozoic pole positions, give us grounds for considering the upper half of the Paleozoic as the most convenient interval in which to test and demonstrate basic paleomagnetic hypotheses. The work here reported, which was carried out on Paleozoic cross-sections in the intermontane basins of the Sayan-Altai folded region, constitutes only a part of the research that is being conducted throughout the Asiatic part of the USSR with the object of group-by-group comparison of paleomagnetic sections. Author (TAB)

N67-28562# Defence Research Board, Ottawa (Ontario).
METHOD OF DETERMINING POINTS OF INFLEXION OF FUNCTIONS FROM THEIR GRAPHS
G. G. Rempel' Oct. 1966 4 p Transl. into ENGLISH from Geol. i Geofiz., Akad. Nauk SSR, Sibirsk. Otd. (Novosibirsk), v. 5, 1966 p 172–173
(T-467-R; AD-649524) CFSTI: HC $3.00/MF $0.65

There exist several methods of interpreting magnetic anomalies, gravity anomalies and electrical anomalies which make use of the position of an inflexion point, this being one of the firmest points in anomaly graphs. The application of these methods is somewhat restricted by the difficulty of locating inflexion points. A method is given of determining them and a simple instrument is described for carrying out the operation most speedily. Author (TAB)

N67-28563# Defence Research Board, Ottawa (Ontario).
PRELIMINARY STUDY OF PALEOMAGNETISM OF SOME MESOZOIC AND CENOZOIC RED BEDS OF SOUTH CHINA
Chuan-ti Lee, Hwa-me Lee, Liu Haishan, Liu Chun, and Shu-juan Yeh Oct. 1966 10 p refs Transl. into ENGLISH from Ti Chih Hsueh Pao (Guozi Shudian), v. 43, no. 3, Aug. 1963 p 241–246
(T-8-C; AD-649525) CFSTI: HC $3.00/MF $0.65

The paper presents data on the paleomagnetic pole position for the Mesozoic and Tertiary, derived from red beds in Xichuan, Yunnan, Hunan, Hubei and Guangdong Provinces. The results obtained by analysis and by comparison with those found from neighbouring countries are summarized as follows: (1) The mean position of the paleomagnetic pole for the Early Tertiary was probably at latitude 78 deg. N, longitude 171 deg. E, and for the Jurassic and Cretaceous was at latitude 59 deg. N, longitude 153 deg. E. Evidently, the paleomagnetic pole has undergone change of position, wandering from low latitudes to high. (2) The middle and upper portions of red beds of the Henyang Basin exibit a reversal of paleomagnetization; hence these rocks are considered to be of Oligocene and Miocene age respectively. Examined by the remagnetized arc method, the magnetizations of all the samples measured are rather stable. Author (TAB)

N67-28566# Defence Research Board, Ottawa (Ontario).
SOME RESULTS OF PALEOMAGNETIC RESEARCH IN CHINA
Chen Zhigiang, Wang Cengchang, and Deng Xinghui Oct. 1966 4 p refs Transl. into ENGLISH from the book "Nastoyashcheye i Proshloye Magnitnogo Polia Zemli" Moscow, "Nauka" Press 1965 p 309–311
(T-462-R; AD-649527) CFSTI: HC $3.00/MF $0.65

A paleomagnetic correlation of red beds belonging to various time-intervals of the Mesozoic and Cenozoic in the Xichuan (Hsichuan), Yunnan, Hunan, Hubei and Guangdong (Canton) areas was made on the basis of the In vector; in connection with this, an approximate estimate of the stability of In was made by the method of remagnetization circles. From these researches the positions of the Jurassic, Cretaceous and Tertiary geomagnetic poles were determined. The results of the paleomagnetic studies in the different areas are briefly outlined. TAB

N67-28567# Defence Research Board, Ottawa (Ontario).
NEW DATA ON THE PALEOZOIC HISTORY OF THE GEOMAGNETIC FIELD IN THE USSR. DIPOLE CHARACTER OF THE GEOMAGNETIC FIELD IN THE LATE CAMBRIAN AND THE ORDOVICIAN IN THE SOUTH OF THE SIBERIAN PLATFORM
A. N. Khramov, V. P. Rodionov, and R. A. Komissarova Oct. 1966 24 p refs Transl. into ENGLISH from the book "Nastoyashcheye i Proshloye Magnitnogo Polia Zemli" Moscow, "Nauka" Press, 1965 p 206–213; from Geol. i Geofiz., Akad. Nauk SSSR, Sibirsk. Otd. (Novosibirsk), v. 1, 1966 p 94–101
(T-460-R; AD-649532) CFSTI: HC $3.00/MF $0.65

A report is given of some of the results gleaned from an extensive paleomagnetic survey of the Russian and Siberian Platforms. The almost complete cross-sections of all of the stratigraphic systems of the Paleozoic which were covered made possible to obtain new and more complete data on the variations of the geomagnetic field at a number of points, and on its distribution in the geologic past. The resulting data are applied to the questions of field inversions in the Paleozoic, the distribution of the field in the geologic past, and horizontal movements of the earth's crust. The second paper reports the results of a paleomagnetic investigation of the Upper Cambrian and Ordovician deposit in riverbank outcrops of the southern Siberian Platform. The data obtained are applied to the problem of whether the geomagnetic field of the remote past was of dipole character. The results do indicate the presence of a central axial dipole character of the field in the time and place under consideration. TAB

N67-28622# Defence Research Board, Ottawa (Ontario). Directorate of Scientific Information Services.
MAGNETIC DISTURBANCE IN THE REGION OF DRIFT OF STATION NORTH POLE 8
N. A. Miliayev Dec. 1966 10 p refs Transl. into ENGLISH from Problemy Arktiki i Antarktiki (Leningrad), Issue 21, 1965 p 72–80
(T-468-R; TT-67-60973; AD-649521) CFSTI: HC $3.00/MF $0.65

In 1959-1961, station North Pole 8 was drifting in the central part of the Arctic Basin. The working program of this

station included absolute observations of magnetic field components Z, H and D and the continuous registration of their variations. TAB

N67-28623# Army Engineer Geodesy, Intelligence and Mapping Research and Development Agency, Fort Belvoir, Va.
A GEOMETRIC SIMULTANEOUS MULTISTATION DETERMINATION, WITH CONSTRAINTS, USING DATA FROM GEODETIC SATELLITES
Lawrence A. Gambino Mar. 1967 23 p refs Presented at the 1966 Army Sci. Conf., West Point, N. Y., 14–17 Jun. 1966
(RN-22; AD-650739) CFSTI: HC$3.00/MF$0.65

The observation equations for two types of satellite tracking systems are derived from a purely geometric standpoint. The introduction of these equations into the adjustment is flexible enough to allow for any combination of data to enter into the formation of the normal equations. Included in the development is the utilization of weight constraints, in which the coordinates of the ground tracking stations and satellite points may be weighted according to how well they are known. The highly patterned character of the large system of normal equations lends itself to inversion by matrix partitioning in which the largest matrix to be inverted is that involving only the tracking station parameters. Thus, for a fixed number of tracking stations the computations will increase only linearly with the number of satellite points used in the reduction. Author (TAB)

N67-28634# Ghana Univ., Legon. Dept. of Physics.
STUDIES OF THE EQUATORIAL IONOSPHERE USING TRANSMISSIONS FROM ACTIVE SATELLITES Annual Summary Report, 1 Feb. 1966–31 Jan. 1966
John R. Koster, I. Katsriku, and M. Tete 1 Aug. 1966 100 p refs
(Contract AF 61(052-800)
(AFCRL-66-814; ASR-1; AD-650722) CFSTI: HC $3.00/MF $0.65

The theory of correlation analysis of fading records is reviewed and computer programs given for carrying out the analysis. Continuous observations over a period of 81 days of the 136 mc/s signal radiated by Early Bird are described. Results include information on diurnal variation of total electron content, and new information on equatorial scintillation and the irregularities giving rise to it. The pattern on the ground was elongated by 60 - 1. The full correlation analysis of nearly 200 spaced receiver drift measurements made at Tamale, Ghana is presented. Drifts are westward by day, eastward by night, reversal occurring at about 07.30 and 20.00 GMT. A mid-morning maximum of about 200 m/sec. is a prominent feature in the F-region drift velocity. Mean F-Region drift velocity is 115 m/sec during the day, and 70 m/sec at night; E-Region velocity is 67 m/sec by day. Correlation ellipses are elongated with axial ratios of about 6 - 1. The total electron content of the ionosphere is studied as determined from observations of the Faraday Rotation of 20 mc/s signals radiated by S-66 over a period of 6 months. The diurnal variation of the electron content, and the development of the equatorial anomaly are shown. Refraction effects are shown to seriously affect 20 mc/s results at even moderate zenith angles. TAB

N67-28675 Deutsche Forschungsanstalt für Luft- und Raumfahrt, Brunswick (West Germany). Institut fuer Flugfuehrung.
THE DETERMINATION OF THE HORIZONTAL STANDARD VISIBILITY BY CONTRAST MEASUREMENTS OF NATURAL OBJECT [DIE BESTIMMUNG DER HORIZONTALEN NORMSICHT DURCH KONTRASTMESSUNGEN AN NATUERLICHEN SICHTZIELEN]
H.-E. Hoffmann Feb. 1967 27 p refs In GERMAN; ENGLISH summary
(DLR-FB-67-11)

Three different methods of contrast determination are treated. Any one of these methods may be used to determine the horizontal standard visibility. Contrast "C", as used here, is the visible contrast between natural objects (forests) and the sky above, when observed from a finite distance. The test performed to determine the value of the constant C_0 (i.e., the contrast observed at zero distance) showed that there is a difference in C_0 for coniferous and deciduous type forests and that C_0 is dependent on the type of object illumination. Differences of contrast were not evaluated for variations in foliage due to seasonal changes, and snow covered objects were not tested. Considering the mean square error values of C_0 and the inaccuracies of the C values which were obtained by using the herein described methods, the percent relative error of the horizontal standard visibility was smallest when photoelectric measuring methods were used. In evaluations under conditions of 30 km standard visibility, the error values obtained in the photoelectric method were always less than 15% for a measuring distance of 4 km (i.e., 4 km between measuring instrument and observed natural object.) Author

N67-28696# White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.
UPPER ATMOSPHERE PRESSURE MEASUREMENTS WITH THERMAL CONDUCTIVITY GAUGES
Otto W. Thiele and Norman J. Beyers Jan. 1967 35 p refs
(ECOM-5110; AD-651216) CFSTI: HC$3.00/MF$0.65

Recent studies of meteorological rocket data have shown a significant diurnal variation of temperature, pressure and density in the stratopause region; however, some doubts have been expressed concerning possible effects on the bead thermistor sensing system which may contribute to the large diurnal changes previously observed. While all known effects have been accounted for and no evidence to the contrary has been offered, it seemed worthwhile to investigate this possibility with an independent system which would not be subject to the external effects encountered by the exposed bead thermistor as employed with standard rocketsondes. Consequently, two pressure soundings, between approximately 30 and 60 km were obtained with thermal conductivity gauges which were incorporated with standard rocketsondes. The thermal conductivity gauges were found to be very efficient and reliable in the low subsonic regime encountered with parachute-suspended sounding systems, and good agreement was obtained between the computed and measured pressure and also between the computed and measured temperature. Author (TAB)

N67-28717# Lincoln Lab., Mass. Inst. of Tech., Lexington.
OBSERVATIONS OF INNER AND OUTER ZONE ELECTRONS SINCE DECEMBER 1965
Jean L. Ryan and Vincent J. Sferrino 28 Dec. 1966 20 p
(Contract AF 19(628)-5167)
(TN-1966-64; ESD-TR-66-603; AD-649139) CFSTI: HC $3.00/MF $0.65

A Silicon Surface Barrier Detector Electron Telescope measuring Integral and Differential Electron Energy Spectra over the range of 130 KEV to 4.5 MEV was placed into orbit in late 1965. The initial orbit had an inclination of 26.6 degrees, apogee of 33,600 KM, perigee of 200 KM, and a mean orbital period of 589.6 minutes. The data from the experiment are presented in terms of single orbit passes on selected days showing outer zone maxima in omnidirectional flux intensity for 130 KEV, 700 KEV, and 2.5 MEV integral Spectra in the region near L=4, and a minimum near L=3.5 which characterizes the slot between the inner and outer zones. Diurnal variations are characterized by flux changes which show marked correlation with K sub p index at L=6. The degree of correlation decreases with decreasing L value. Spectral steepening is seen to occur during periods of increased geomagnetic activity. The diurnal flux changes also exhibit energy vs. time dependencies with the higher energy electron fluxes generally reaching their maximum later in time. Author (TAB)

N67-28750*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE ROLE OF THE MAIN GEOMAGNETIC FIELD IN LOCATING CONJUGATE POINTS
Joseph C. Cain Jun. 1967 13 p refs Prepared at the Conjugate Point Symp., Boulder, Colo., 15 Jun. 1967
(NASA-TM-X-55801; X-612-67-275) CFSTI: HC $3.00/MF $0.65 CSCL 08N

A sample distribution of conjugate points is calculated using various models of the main geomagnetic field evaluated at different epochs. A summary of the conclusions is that: (1) for $L<4$ the errors are of the order of a few tens of kilometers; (2) older models of the field, such as Finch-Leaton, give results within a few degrees of the latest more accurate models; (3) use of the eccentric dipole approximation gives errors that range from a few tens of kilometers at high latitude to several hundred kilometers near the equator; and (4) the secular change of conjugate point locations is very small, averaging 1 to 10 km/yr. Inclusion of Mead's symmetrical boundary field for a trace from Macquarie Island to Alaska ($L=5$) shifts the conjugate only about 100 km. It is concluded that for $L \geq 5$ the field line passes through regions where the field intensity is sufficiently weak that conjugate point determinations should include realistic estimates (not now available) of the distortions due to plasma interactions. Author

N67-28812# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
THE ROLE OF THE TROPOPAUSE IN STRATOSPHERIC–TROPOSPHERIC EXCHANGE PROCESSES
E. R. Reiter, M. E. Glasser, and J. D. Mahlman Jan. 1967 82 p refs *Its* Atmospheric Science Paper No. 107
(Contract AT(11-1)-1340)
(COO-1340-9) CFSTI: HC $3.00/MF $0.65

In a previous study Reiter and Mahlman estimated the amount of stratospheric air intruding into the stable layer of the jet stream front in a case of cyclogenesis not accompanied by surface radioactive fallout. The same case is examined on a more general basis. Outflow from, as well as inflow into, the stratosphere is estimated over the entire thickness of the "tropopause gap." Author (NSA)

N67-28851 National Physical Lab., New Delhi (India). Radio Propagation Unit.
SOLAR AND GEOPHYSICAL DATA, PART 2
Oct. 1966 12 p
(RRC-A136, Pt. 2)

Tabulated solar and geophysical data pertaining to ionospheric studies were obtained from four participating Indian stations during October 1966. Cooperating organizations are listed as well as predicted sunspot numbers, observed sunspot numbers, optical observations of solar flares, solar flux measurements, solar flare effects, magnetic storms, and ionospheric effects of solar flares. S.P.

N67-28907*# Boeing Co., Seattle, Wash. Geo-Astrophysics Lab.
THE SCALE SIZE OF SCINTILLATION-PRODUCING IRREGULARITIES IN THE AURORAL IONOSPHERE
E. J. Fremouw (Univ. of Alaska) and J. M. Lansinger Jan. 1967 32 p refs
(Contract NAS5-3940; Grant NSF-GP-5540)
(NASA-CR-84900; D1-82-0594; AD-651156) CFSTI: HC $3.00/MF $0.65 CSCL 04A

Measurements of the transverse scale of F-layer irregularities, based on radio-star observations from College, Alaska, at frequencies of 68 and 223 MHz, are reported. Analysis by the two-frequency scintillation-ratio technique yields typical scales of 600 to 700 meters for mid-auroral latitudes. Typical scales of one kilometer are found for higher-latitude irregularities. The latter show increasing scale with increasing magnetic index. Analysis by the two-frequency correlation technique produces erroneously small scales due to refraction effects. Author (TAB)

N67-28925# Royal Aircraft Establishment, Farnborough (England).
COMPARISON OF AIR DENSITIES OBTAINED FROM ORBITAL DECAY AND INSTRUMENTS
G. E. Cook Nov. 1966 25 p refs Presented at the Roy. Soc. Meeting on Orbital Anal., London, 17–18 Oct. 1966
(RAE-TR-66370) CFSTI: HC $3.00/MF $0.65

Methods for determining upper atmosphere density are briefly reviewed. Values of air density derived from orbital decay are compared with those obtained from instruments and shown to be systematically higher. The difference is too large to be due entirely to errors in the drag derived values and cannot be explained at present if the absolute accuracy claimed for the gauges is realistic. Author (ESRO)

N67-28939*# Volt Technical Corp., Washington, D. C.
INVESTIGATION OF THE EQUATORIAL ANOMALY OF THE IONOSPHERE IN THE EAST ASIATIC ZONE OF THE PACIFIC OCEAN [ISSLEDOVANIYE EKVATORIAL'NOY ANOMALII IONOSFERY V VOSTOCHNO AZIATSKOY ZONE TIKHOGO OKEANA]
G. M. Artem'yeva, Yu. S. Korobkov, and V. V. Pisareva 23 May 1967 6 p refs Transl. into ENGLISH from Geomagnetizm i Aeronomiya (Moscow), v. 7, no. 2, 1967 p 353–357
(Contract NAS5-12487)
(NASA-CR-84876; ST-AI-GM-10612) CSCL 04A

The investigation of the ionosphere in the Pacific Ocean region was carried out by vertical sounding from a ship. The results obtained are discussed with regard to the positions of the F2-layer maximum, the course of f_0F2, as related to the various cycles of solar activity and seasons. Author

N67-28940*# Volt Technical Corp., Washington, D. C.
THE NONDIPOLE PART OF THE GEOMAGNETIC FIELD IS MANIFEST AT MAGNETOSPHERE BOUNDARY [NEDIPOL'NAYA CHAST GEOMAGNITNOGO POLYA SKAZYVAYETSYA NA GRANITSE MAGNITOSFERY]
Yu. D. Kalinin 22 May 1967 4 p refs Transl. into ENGLISH from Geomagnetizm i Aeronomiya (Moscow), v. 7, no. 2, 1967 p 341–342
(Contract NAS5-12487)
(NASA-CR-84877; ST-GM-PF-10610) CFSTI: HC $3.00/MF $0.65 CSCL 04A

The author establishes that the magnetosphere boundary is located above the daytime part of the Earth at distances from the center of the Earth, functions of not only interplanetary plasma parameters, but also of the nondipole part of the geomagnetic field, on the basis of data of Explorer-12 and -18. Author

N67-28966# Army Cold Regions Research and Engineering Lab., Hanover, N. H.
SOME THERMODYNAMIC RELATIONSHIPS FOR SOILS AT OR BELOW THE FREEZING POINT. FREEZING POINT DEPRESSION AND HEAT CAPACITY
Philip F. Low (Purdue Univ.), Duwayne M. Anderson, and Pieter Hoekstra Dec. 1966 22 p refs
(CRREL-RR-222; AD-649729) CFSTI: HC $3.00/MF $0.65

An extended equation was derived relating the relative partial molar free energy of water in a soil to its freezing point depression and relative partial molar heat content. The equation was used to prepare a table from which each of these 3 quantities can be ascertained if the other 2 are known. The table was used with experimental data to obtain a curve of freezing point depression vs. water content for Na-Wyoming bentonite. Provided the activity of the liquid water in the clay is a single-valued function of the

liquid water content and that the ice has the properties of pure bulk ice. this curve also represents the relationship between freezing point depression and unfrozen water in the partially frozen clay. An equation for the heat capacity of a partially frozen soil was also derived. This equation was employed to calculate the heat capacities of the clay at different water contents and sub-zero temperatures. A comparison of the calculated unfrozen water contents and heat capacities of the partially frozen Na-Wyoming bentonite with the available experimental data indicated satisfactory agreement, especially as regards the unfrozen water contents. TAB

N67-28979# Lowell Technological Inst. Research Foundation, Mass.
DETERMINATION OF A D-REGION NITRIC OXIDE DENSITY PROFILE BY VLF RADIO PROPAGATION
Daniel P. Hayes and Gary S. Sales Feb. 1967 38 p refs
(Contract AF 19(628)-4801)
(SR-1; LTIRF-264/IP; AFCRL-67-0170; AD-650873) CFSTI: HC $3.00/MF $0.65

Experimental VLF radio propagation data was to deduce a D-region Nitric Oxide density profile in the 70-90 km height range. Author (TAB)

14 INSTRUMENTATION AND PHOTOGRAPHY

Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras.

N67-27791# Aeroplane and Armament Experimental Establishment, Bascombe Down (England).
THE PROTECTION OF A AND A. E. E. WIRE AND OPTICAL TRACE ACCIDENT RECORDERS
G. H. Hillier 9 May 1966 25 p refs
(AAEE/TECH/294/WEA) CFSTI: HC $3.00/MF $0.65

Consideration is given to a series of tests on protective devices for accident recorders, and the experience gained from aircraft accidents in which some of them were involved. Author

N67-27794# Royal Aircraft Establishment, Farnborough (England).
CONTRIBUTION TO THE INVESTIGATION OF DYNAMIC ERRORS OF THE AXES OF ROTATION OF A CINE-THEODOLITE [BEITRAG ZUR ERMITTELUNG DER DYNAMISCHEN DREHACHSENFEHLER EINES KINOTHEODOLITS]
H. E. Hoffmann Oct. 1966 87 p refs Transl. into ENGLISH from German
(RAE-LIB-TRANS-1190) CFSTI: HC $3.00/MF $0.65

Dynamic instrument errors of a cinetheodolite were investigated. The influence of vertical axis and horizontal axis errors on the results of cinetheodolite measurements is discussed and the test equipment used is described. The test equipment permits static measurements with an accuracy of 2 seconds of arc and dynamic measurements with an accuracy of 12 seconds of arc. By means of this equipment, not only the values of the dynamic vertical and horizontal axis errors, but also one of their sources, were determined. For the vertical axis, error values up to 200 seconds of arc were found, and, for the horizontal axis errors, values up to 50 seconds of arc. The main reason for the large values of the vertical axis error is insufficient banding stiffness of the cinetheodolite support. Author

N67-27800# Royal Aircraft Establishment, Farnborough (England).
SPECTRAL TRANSMISSION OF TWO OPTICAL SYSTEMS
A. E. Smith Jan. 1967 21 p refs
(RAE-TR-67010) CFSTI: HC $3.00/MF $0.65

In the calibrations of a star tracking system it is essential that the spectral transmission of the associated telescope is known. This report describes measurements made on two optical designs, one in use in an experimental star tracking system and one envisaged as a possible design for future systems. Author

N67-27821 Joint Publications Research Service, Washington, D. C.
IZVESTIYA VUZOV: INSTRUMENT BUILDING, VOLUME IX, NO. 6, 1966
27 Mar. 1967 197 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Priborostr. (Leningrad), v. IX, no. 6, 1966 p 3–144
(TT-67-31045; JPRS-40400)

A compilation of Soviet articles is presented on instrument designs and operational principles. For individual titles, see N67-27822 through N67-27853.

N67-27826 Joint Publications Research Service, Washington, D. C.
INDUCTANCE-TYPE TRANSDUCER WITH CORRECTING WINDINGS
I. A. Limanov and M. A. Federov *In its* Izv. VUZov: Instr. Bldg., Vol. 9, No. 6 27 Mar. 1967 p 18–20 refs (See N67-27821 15-14)

A description is presented of an inductance-type transducer with correcting (compensating) windings designed for checking and measuring various nonelectrical values and processes. Author

N67-27827 Joint Publications Research Service, Washington, D. C.
A METHOD OF LINEARIZING THE CHARACTERISTICS OF VIBRATION AND STRING TRANSDUCERS
V. I. Sergeyev *In its* Izv. VUZov: Instr. Bldg., Vol. 9, No. 6 27 Mar. 1967 p 21–25 refs (See N67-27821 15-14)

A method is presented for linearizing the characteristics of vibration and string-type transducers. It includes the derivation of analytical expressions and plotting of experimentally obtained and calculated relationships which characterize the errors of this method of linearization. Author

N67-27828 Joint Publications Research Service, Washington, D. C.
CERTAIN PROBLEMS CONNECTED WITH THE SYNTHESIS OF CAPACITANCE TRANSDUCERS
A. Ye. Zverev, V. I. Mazilkin, and I. N. Filippov *In its* Izv. VUZov: Instr. Bldg., Vol. 9, No. 6 27 Mar. 1967 p 26–30 refs (See N67-27821 15-14)

Certain problems are discussed which are connected with the synthesis of capacitance transducers of angular displacements into digital codes. The possibility of composing an equation for the coding unit with the aid of a polynomial of specified power is investigated. Author

N67-27829 Joint Publications Research Service, Washington, D. C.
METHOD OF MEASURING RAPIDLY-CHANGING TEMPERATURES
R. K. Azimov, I. Z. Kopp, Yu. G. Mikhalenko, and I. V. Redchenko *In its* Izv. VUZov: Instr. Bldg., Vol. 9, No. 6 27 Mar. 1967 p 31–34 refs (See N67-27821 15-14)

A method of measuring rapidly-changing temperatures with the aid of thermocouples is described. High sensitivity and inertialess measuring of small temperature variations is obtained by using dynamic corrections of the readings. Author

N67-27844 Joint Publications Research Service, Washington, D. C.
CONCERNING THE INVERSE PROBLEM OF THE GYROSTABILIZER THEORY
I. M. Budnyatskiy and Ya. L. Lunts *In its* Izv. VUZov: Instr. Bldg., Vol. 9, No. 6 27 Mar. 1967 p 101–107 (See N67-27821 15-14)

The deflections of a three-axis gyrostabilized platform are determined. Unlike the conventional way of setting up this type of problem by specifying the vibration of the base, it is assumed in this case that the oscillations of the gyroscopic blocks with respect to the gyrostabilized platform are known. This information makes it possible to determine the deflections of the platform from the inertial space. The gyroscopic blocks are assumed to be ideally balanced; along their axes of precession are acting the forces of dry and viscous friction. Author

N67-27845 Joint Publications Research Service, Washington, D. C.
RECORDER OF TRAJECTORY OF GYROPENDULUM MOTION
V. Yu. Torochkov and N. A. Zatravkin *In its* Izv. VUZov: Instr. Bldg., Vol. 9, No. 6 27 Mar. 1967 p 108–110 (See N67-27821 15-14)

Details are presented on an instrument designed for photographic recording of the trajectory of gyropendulum motion. The device incorporates a shutter which opens only at the moment of time for recording the trajectory. Author

N67-27846 Joint Publications Research Service, Washington, D. C.
AXIS EQUILIBRIUM POSITION IN SPERRY MK19-GYROCOMPASS
V. V. Seregin *In its* Izv. VUZov: Instr. Bldg., Vol. 9, No. 6 27 Mar. 1967 p 111–117 refs (See N67-27821 15-14)

Under consideration are the coordinates of the axis-equilibrium position in gyrocompasses equipped and unequipped with momentum pickups for compensating the gyroscopic moments due to the earth's rotation and the motion of the base. An investigation is made of the deflection of the gyrocompass axis from equilibrium position caused by inaccurate introduction of the mentioned compensation. Author

N67-27847 Joint Publications Research Service, Washington, D. C.
MEASUREMENT OF ABSOLUTE ANGULAR VELOCITY OF AIRCRAFTS BY MEANS OF LINEAR ACCELEROMETERS
V. I. Lopatin *In its* Izv. VUZov: Instr. Bldg., Vol. 9, No. 6 27 Mar. 1967 p 118–124 refs (See N67-27821 15-14)

Under consideration are the possible versions of locating linear accelerometers in the housing of an aircraft. It is shown that the algorithm of computation of the components of its angular velocity and angular acceleration depend on the orientation of the axis of sensitivity and on the number of accelerometers. Author

N67-27848 Joint Publications Research Service, Washington, D. C.
MONOCHROMATOR WITH HIGHLY ACCURATE DIRECTION OF SPECTRUM TO THE OUTLET SLIT
Yu. K. Mikhaylovskiy *In its* Izv. VUZov: Instr. Bldg., Vol. 9, No. 6 27 Mar. 1967 p 125–127 refs (See N67-27821 15-14)

Details are given on the optical and mechanical principles of monochromators which direct the spectrum with high precision. The main parameters are given for such instruments. Author

N67-27849 Joint Publications Research Service, Washington, D. C.
METHOD OF REDUCING THE VIGNETTING OF BEAMS OF LIGHT WITH AUTOCOLLIMATION AT LARGE DISTANCES
M. Ya. Gukalyo *In its* Izv. VUZov: Instr. Bldg., Vol. 9, No. 6 27 Mar. 1967 p 128–131 (See N67-27821 15-14)

A prism is described which, unlike spherical mirrors, eliminates the sensitivity of autocollimation hotspots to transverse displacements. It also reduces considerably the vignetting of beams of light. Author

N67-27850 Joint Publications Research Service, Washington, D. C.
THE CHECKING OF CONCAVE ASPHERICAL SURFACES
D. A. Khomutov *In its* Izv. VUZov: Instr. Bldg., Vol. 9, No. 6 27 Mar. 1967 p 132–137 refs (See N67-27821 15-14)

A method of inspecting concave aspherical surfaces with large and small deformations of the second and highest orders is described. Intermediate hemispherical probing glasses made by fine grinding and polishing are used. Author

N67-27851 Joint Publications Research Service, Washington, D. C.
PHOTOGRAPHIC BRIGHTNESS PYROMETER FOR THERMOPHYSICAL MEASUREMENTS
Ye. S. Platunov and Yu. P. Shramko *In its* Izv. VUZov: Instr. Bldg., Vol. 9, No. 6 27 Mar. 1967 p 138–139 refs (See N67-27821 15-14)

A photographic pyrometer for recording temperature fields, in which the temperature varies arbitrarily within a wide range, is described. Compared with other known pyrometers, this instrument offers an advantage in measuring small differences in high temperatures. Author

N67-27878 Central Lab. for Radiological Protection, Warsaw (Poland).
SOLID STATE ELECTROMETER AMPLIFIER FOR HEALTH PHYSICS INSTRUMENTATION [TRANZYSTOROWY WZMACNIACZ ELEKTROMETRYCZNY DLA CELOW DOZYMETRII]
W. Katkiewicz 1966 14 p refs
(CLOR-61/D)

Insulated gate n-channel MOSFETs were checked for electrometer applications. Input resistance of 10^{13}–10^{14} ohms, minimum temperature coefficient of 0.4 mV/°C, and long term drift 5 mV per 12 hours were observed. The simple electrometer amplifier for ionization chamber with current sensitivity of 10^{-13}A for full deflection of meter, temperature drift 0.1 mV/°C and long term drift 0.3 mV per 12 hours, is described. Author

N67-27901# Atomic Energy Commission Research Establishment, Riso (Denmark).
ELECTRONICS DEPARTMENT Quarterly Report, 1 Jul.–30 Sep. 1966
Nov. 1966 23 p refs In DANISH and ENGLISH
(RISO-M-501; R-10-66) CFSTI: HC $3.00/MF $0.65

Instrumentation of reactor irradiation experiments using an on-line computer (PDP-8) are discussed. Topics include data transmission from neutron spectrometers, interface equipment between analog systems and digital computers, analog model of human blood circuit dynamics, and β and γ detector electronics. NSA

N67-27905# Westinghouse Electric Corp., Pittsburgh, Pa. Atomic Power Div.
DEVELOPMENT OF A BORON CONCENTRATION METER Technical Progress Report, Period Ending Sep. 30, 1966

Oct. 1966 25 p
(Contract AT(30-1)-3690)
(WCAP-3690-1; EURAEC-1722) CFSTI: HC $3.00/MF $0.65

In the development of a boron concentration meter, laboratory tests were carried out on the effects of fructose, mannitol, and glycerol on the conductivity of boric acid solutions. After conductivity tests, glycerol was eliminated from further testing because of comparatively low effectiveness in increasing conductivity. Further research and calculations were carried out with fructose and mannitol in regards to temperature dependence, measurement accuracy, and system conceptual design. It was concluded that, although the delay time criteria probably can be met, accuracy requirements may be difficult to achieve on an in-line instrument, and operational costs will be significant. NSA

N67-27906# Israel Program for Scientific Translations, Ltd., Jerusalem.
THICKNESS-MEASURING DEVICE BASED ON RADIOACTIVE SOURCES FOR AUTOMATIC GAGING OF FILMS AND SHEETS DURING PRODUCTION [RADIOAKTIVNYI TOLSHCHINOMER DLYA AVTOMATICHESKOGO KONTROLYA TOLSHING PLENOCHNYKH I TISTOVYKH MATERIALOV V PROTSESSE IKH IZGOTOVLENIYA]
Yu. Ya. Loznovskii 1966 19 p refs Transl. into ENGLISH from Russian
(NP-TR-1477; TT-65-50134; IPST-CAT-1430)

The radiation .thickness gage is described which can be used for the noncontact continuous thickness measurement of materials of different chemical composition and density. By a suitable choice of radioisotopes and modification of the construction of the measuring unit it is possible to measure the thickness of various areas of different plastic and sheet materials. Using sources of a narrow rectangular shape one can measure the thickness of narrow strips of material. Using point-type radiation sources one can measure an area of several square millimeters. The radiation thickness gage is of simple construction, comparatively inexpensive to produce, and does not require skilled service personnel. The thickness gage, in use since August 1961 till the present, has proved that the electronic circuitry is reliable, and that the whole maintenance consists mainly of the timely replacement of electronic tubes. Author (NSA)

N67-27912# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
ANTICOINCIDENCE SHIELDED MULTIDIMENSIONAL GAMMA-RAY SPECTROMETERS FOR LOW LEVEL COUNTING
J. M. Nielsen and R. W. Perkins 16 Dec. 1966 14 p refs Presented at IAEA Symp. on Radioact. Dating and Methods of Low-level Counting, Vienna
(Contract AT(45-1)-1830)
(BNWL-SA-927; CONF-670304-1) CFSTI: HC $3.00/MF $0.65

A large anticoincidence shielded multidimensional gamma spectrometer is described, which is capable of measuring and providing energy spectra of some gamma emitters at levels of a few tenths of a disintegration per minute. NSA

N67-27914# Brookhaven National Lab., Upton, N. Y.
CRYSTAL SPECTROMETERS FOR THE MEASUREMENT OF GAMMA RADIATION FROM NEUTRON CAPTURE
O. W. B. Schult [1966] 5 p refs Presented at Slow-Neutron Capture Gamma-Ray Conf., Argonne, Ill.
(Contract AT(30-1)-GEN-16)
(BNL-10991; CONF-661113-6) CFSTI: HC $3.00/MF $0.65

The use of focussing and flat crystal spectrometers for neutron capture–gamma ray spectrum measurements is discussed. The crystal spectrometers are then compared with the Ge(Li) spectrometer. NSA

N67-27942# Army Engineer Research and Development Labs., Fort Belvoir, Va.
A MOESSBAUER SPECTROMETER
Edward F. Allard *In* Army Dept. Proc. of the 1966 Army Sci. Conf., Vol. I 26 Aug. 1966 p 13–21 ref (See N67-27941 15-34)
(AD-634658)

Azide and picric salts used in military explosives are studied by Mossbauer spectroscopy to determine the effects of impurities and imperfections in crystals. The spectrometer is operated in the constant acceleration mode, and positive and negative velocities are obtainable with one sweep of the 400 channel analyzer. Operation in constant acceleration mode as opposed to constant velocity mode offers the advantage that no correction is necessary for radioactive decay of the source, and this is important for sources with short half-lives. The constant velocity mode is used to detail any portion of the spectrum obtained from the acceleration mode. Mention is made of the standard reference material, a single crystal of disodium pentacyanonitrosoferrate dehydrate that is called sodium nitroprusside, which is available through the National Bureau of Standards. M.W.R.

N67-27962# Army Nuclear Defense Lab., Edgewood Arsenal, Md.
SUPERCONDUCTING THIN-FILM NUCLEAR-PARTICLE DETECTORS
James B. Greer, Donald B. Sullivan, and Walter R. Van Antwerp *In* Army Dept. Proc. of the 1966 Army Sci. Conf., Vol. I 26 Aug. 1966 p 375–388 refs (See N67-27941 15-34)
(AD-634684)

A thin superconducting film is shown to be feasible for the detection of nuclear particles, although the use of the detector in the propagating-pulse mode necessitates several microseconds to complete the transition and return the detector to its superconducting state. A thermodynamic treatment of the model detector is presented, and major components of the experimental probe are shown. The position-sensitive operation in the superconducting mode is noted. M.W.R.

N67-27964# Ballistic Research Labs., Aberdeen Proving Ground, Md.
PRECISION OF MEASUREMENT, ACCURACY AND PROCEDURES FOR DETECTING OUTLYING OBSERVATIONS
Frank E. Grubbs *In* Army Dept. Proc. of the 1966 Army Sci. Conf., Vol. I 26 Aug. 1966 p 405–419 refs (See N67-27941 15-34)
(AD-634686)

Precision is considered as the reproducibility of measurements, while accuracy is based on the measurement of the true value. Accuracy requires precision, but precision does not necessarily imply accuracy. Accuracy, therefore, depends upon standard deviation and the amount of bias, while precision is measured only by the standard deviation. A graphical representation of both concepts is presented, and the detection of outlying observations is treated. These outliers are defined as observations that appear to deviate markedly from other members of a sample. An outlying observation may be either (1) an extreme manifestation of the random reliability inherent in the data or (2) the result of gross deviation from procedure or an error. Basis of the statistical criteria for these outliers is presented, and criteria are recommended for single samples and for samples with two or more outliers. M.W.R.

N67-28064# Reactor Centrum Nederland, Petten.
FOCUSING OF A TRIPLE-AXIS NEUTRON SPECTROMETER WITH THE AID OF A GRAPHICAL METHOD
J. Bergsma and C. Van Dijk *In* Brookhaven Natl. Lab. Symp. on Inelastic Scattering of Neutrons by Condensed Systems Mar. 1966 p 163–168 refs Supported in part by Inst. for Atomenergi, Norway (See N67-28041 15-24)

The theory of focusing a triple-axis neutron spectrometer for the study of inelastic neutron scattering in crystals is discussed. From its definition, i.e., incoming neutrons which exhibit a certain wave vector spread δk_0 are scattered inelastically by the same phonon (or magnon) with one scattered wave vector k_1, and conversely outgoing neutrons, which leave the analyzer crystal with a wave vector spread δk, arising from one wave vector k_0, the focusing conditions for a triple-axis spectrometer are derived analytically. These conditions are found to be: $\pm s/2 = k-(k-m)\,|k-m|$ where $s=|s|$ with s the scattering vector at the monochromator or analyzer crystal, k is the incoming or scattered neutron wave vector, and $m=(m_n/h)\nabla\omega$ with $\nabla\omega$ the gradient of the dispersion relation. The loci of vectors k satisfying this expression can easily be constructed. From the resulting graphs it is often possible to select a combination of incoming and scattered wave vectors which define the observation of a particular phonon. In this way the focusing parameters for the triple-axis spectrometer are found rather directly. The method shows also quite clearly the experimental limitations for operation of the triple-axis spectrometer under focused conditions. Author

N67-28101 Joint Publications Research Service, Washington, D. C.
IZVESTIYA VUZOV: INSTRUMENT BUILDING, VOLUME IX, NO. 2, 1966
23 Feb. 1967 186 p refs Transl. into ENGLISH of Izv. Vysshikh Uchebn. Zavedenii, Priborostr. (Leningrad), v. IX, no. 2, 1966 p 3–142
(JPRS-39996; TT-67-30643)

Articles on radioelectronic, electrical measuring, automation and remote control, computer, gyroscopic, navigational, and thermal instruments and devices are presented. For individual titles see N67-28102–N67-28130.

N67-28102 Joint Publications Research Service, Washington, D. C.
PHASEMEASURING METHOD IN DUAL-BEAM ULTRAVIOLET ANALYZER IN OIL REFINING
A. A. Tudorovskiy, Yu. V. Popov, and V. M. Osipov *In its* Izv. VUZov: Instr. Bldg., Vol. 9, No. 2 23 Feb. 1967 p 1–6 refs (See N67-28101 15-14)

Consideration is given to the principle of operation of a dual-beam ultraviolet analyzer based on the phase measuring method. Basic estimated relationships are given for the analyzer scale, and the advantages of employing this method are demonstrated. Author

N67-28103 Joint Publications Research Service, Washington, D. C.
DISTRIBUTION OF ELECTRICAL FIELD IN GAS-DISCHARGE METERS AT MOMENT OF RADIATION RECORDING
V. D. Kuchin *In its* Izv. VUZov: Instr. Bldg., Vol. 9, No. 2 23 Feb. 1967 p 7–11 (See N67-28101 15-14)

The electrical field of gas discharge meters is calculated for stationary conditions with the simplest formulas of electrostatics. In order to determine the basic characteristics of gas discharge meters (dead time), it is necessary to know the law of electrical field strength change in meters at the moment they are functioning. A method is proposed of calculating the field of a meter considering the influence of volumetric charge. The radius field distribution for a meter at the moment of radiation recording is determined. Author

N67-28105 Joint Publications Research Service, Washington, D. C.
UNIVERSAL DEVICE FOR INVESTIGATING AND PHOTOGRAPHING ELECTROMAGNETIC SUPERHIGH FREQUENCY FIELDS
M. G. Aleksandrova, A. L. Zelenkov, V. N. Rudakov, and A. I. Lebedev *In its* Izv. VUZov: Instr. Bldg., Vol. 9, No. 2 23 Feb. 1967 p 19–22 (See N67-28101 15-14)

A universal device for photographing and studying superhigh frequency electromagnetic fields is described. The device can also be employed as a radio defectoscope and radio polaroscope. The results of several experiments are included. Author

N67-28106 Joint Publications Research Service, Washington, D. C.
PROTECTING BALANCING CIRCUIT OF AUTOCOMPENSATING ELECTROMAGNETIC FLOW INDICATOR FROM LEAKAGE CURRENTS
Ye. G. Abarinov *In its* Izv. VUZov: Instr. Bldg., Vol. 9, No. 2 23 Feb. 1967 p 23–28 refs (See N67-28101 15-14)

Sources and means of capacitive leakage currents in the receiver device of an electromagnetic flow indicator are examined. An automatic rectangular coordinate alternating current compensator is proposed as a method of eliminating the effect of these leakage currents on measurement accuracy. Author

N67-28108 Joint Publications Research Service, Washington, D. C.
SOME CRITERIA OF QUALITY OF MAGNETOELECTRIC MOMENTUM CONVERTERS
T. S. Astashevskaya *In its* Izv. VUZov: Instr. Bldg., Vol. 9, No. 2 23 Feb. 1967 p 33–35 ref (See N67-28101 15-14)

Quality criteria are examined in order to determine maximum design efficiency. Based on these data, a comparison is made of various types of magnetoelectric momentum converters. Author

N67-28110 Joint Publications Research Service, Washington, D. C.
ELECTROSTATIC METHOD OF COMPENSATING OPPOSING MOMENTUM
K. L. Kulikovskiy and Ye. P. Kurochkin *In its* Izv. VUZov: Instr. Bldg., Vol. 9, No. 2 23 Feb. 1967 p 42–45 refs (See N67-28101 15-14)

Details are given on an original method of compensating galvanometer tension member opposing momentum using two alternating capacitance condensers, the rotor of which is the galvanometer frame. Included are calculations and experimental results. Author

N67-28122 Joint Publications Research Service, Washington, D. C.
FORCED OSCILLATIONS OF GYROSCOPIC TACHOMETER WITH DRY FRICTION
A. M. Lestev *In its* Izv. VUZov: Instr. Bldg., Vol. 9, No. 2 23 Feb. 1967 p 104–110 refs (See N67-28101 15-14)

Forced oscillations of a gyroscopic tachometer with dry friction are examined. A determination is made of forced axial oscillation types and conditions for their existence, and the amplitude of forced oscillations is calculated. Author

N67-28123 Joint Publications Research Service, Washington, D. C.
EFFECT OF RADIAL RIGIDITY OF GYROSCOPIC CHAMBER UPON GYROSCOPIC OSCILLATIONS
Yu. M. Kamashev *In its* Izv. VUZov: Instr. Bldg., Vol 9, No. 2 23 Feb. 1967 p 111–116 refs (See N67-28101 15-14)

Determinations are made of the forced oscillation amplitudes of a gyroscopic instrument in the presence of dynamic rotor imbalance, considering gyroscopic chamber radial rigidity. The study of oscillations is conducted with consideration of radial rigidity of gyroscopic chamber covers. Author

N67-28124 Joint Publications Research Service, Washington, D. C.

STABLE EQUILIBRIUM OF CYLINDER AXIS IN ROTATING FLUID VOLUME

Ye. A. Nikitin *In its* Izv. VUZov: Instr. Bldg., Vol. 9, No. 2 23 Feb. 1967 p 117–120 (See N67-28101 15-14)

Consideration is given to the problem of stable equilibrium of a cylinder rotation axis in a rotating chamber filled with one or two fluids. A relation has been obtained between float inertia moments and expelled volumes of fluid, whereby the coaxial state of the cylinder axis and fluid rotation axis is a state of stable equilibrium. This problem has applied significance in designing float accelerometers with hydrodynamic suspension. Author

N67-28125 Joint Publications Research Service, Washington, D. C.

MEASURING PULSE WORK AND RELEASE WORK IN ELECTRONIC TIME-MEASURING DEVICES

V. I. Royzman *In its* Izv. VUZov: Instr. Bldg., Vol. 9, No. 2 23 Feb. 1967 p 122–128 (See N67-28101 15-14)

Formulas are presented expressing the relation between pulse and release work and the electrical and mechanical parameters of electronic time-measuring instruments with magnetoelectric drive. It is demonstrated that the values of quantities contained in the formulas can be measured with the aid of an electron beam oscillograph. Author

N67-28126 Joint Publications Research Service, Washington, D. C.

TEMPERATURE FIELD MEASUREMENT OF THIN OBJECTS

Z. F. Slezenko *In its* Izv. VUZov: Instr. Bldg., Vol. 9, No. 2 23 Feb. 1967 p 129–132 refs (See N67-28101 15-14)

Experiments are described in which a heat insulation is used to examine a thin layer of organic composition. Temperature variations along the length of the rod are delineated, and the temperature distribution equation in the heat insulated thermocouple is derived. Temperature measurement errors and errors caused by thermocouple electrode heat removal are determined. M.G.J.

N67-28128 Joint Publications Research Service, Washington, D. C.

SPHERE CALORIMETER FOR DETERMINING THERMAL CONDUCTIVITY OF LIQUIDS AND GASES

A. K. Abas-zade, K. D. Guseynov, and A. A. Gylmanov *In its* Izv. VUZov: Instr. Bldg., Vol. 9, No. 2 23 Feb. 1967 p 136–140 refs (See N67-28101 15-14)

Details are given on the design variations made to a regular sphere bicalorimeter in order to conduct studies on the influence of pressure and temperature on the heat conductivity of liquids and gases. Data are included on the results of experiments with liquid H-nonane and H-decane in the temperature interval 289° to 350°K at pressures of $1 \cdot 10^1 - 150 \cdot 10^5$ m/m^2. Author

N67-28202# Universidad Nacional Autonoma de Mexico, Villa Obregon. Facultad de Ciencias.

MEASUREMENT OF LOW ENERGY AND LOW ACTIVITY β RADIATION [MEDICION DE RADIACION β DE BAJA ENERGIA Y BAJA ACTIVIDAD]

Domingo Navarro Cuevas 1965 105 p refs In SPANISH (NP-16534)

The design of an apparatus for the measurement of low energy and low activity β radiation with the imposition of extreme limitations on the background count was described. A detector of the scintillation type was chosen. The interaction of β and γ radiation with matter is first considered. The formulas to calculate the shielding necessary for the background reduction and to calculate the energy absorbed by the phosphor are given. The most important properties of the known phosphors are outlined. The photomultiplier tube used in the detection instrument is studied with separate consideration given to each part of the tube as well as to the yield and the counting efficiencies of the photoelectric materials and of the different types of dynodes. The obscurity currents were also studied. The criteria for the selection of the detector are outlined. NSA

N67-28327# Ballistic Research Labs., Aberdeen Proving Ground, Md.

AERODYNAMIC AND FREQUENCY DEPENDENT ERRORS IN AN AIR BLAST GAGE

Henry J. Goodman Oct. 1966 66 p refs (BRL-R-1345; AD-649461) CFSTI: HC $3.00/MF $0.65

Tests were conducted in the supersonic and hypersonic wind tunnel to determine the aerodynamic error due to mass flow around a pancake type gage. This air blast gage was used extensively to measure the transient side-on pressure generated by an explosive charge. Data on flat surfaces are also presented. The error due to mass flow is a function of both Mach number and Reynolds number. Error is largest near Mach one. Measurements of impulse on gages with various shapes of pulses are considered. If there is no negative phase, impulse is independent of the gage size; the negative phase results in a low value of impulse for a gage longer than 1/10 the length of the positive phase. Author (TAB)

N67-28338# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THEORY OF THE GYROSCOPE AND GYROSCOPIC INSTRUMENTS

V. A. Pavlov 31 Oct. 1966 643 p refs Transl. into ENGLISH of the book "Teoriy Giroskopa i Giroskopicheskikh Priborov" Leningrad, Izd. Sudostroyeniye, 1964 495 p (FTD-HT-66-267; TT-67-61393; AD-649420) CFSTI: HC $3.00/MF $0.65

The volume is designed as a textbook for students in higher technical institutes specializing in gyroscopic instrumentation. It sets forth applied gyroscope theory, the fundamentals of the theory of gyroscopic instruments used in stabilization and control systems for moving vehicles, and the working principles, design peculiarities and methodical and certain instrumental errors of single-rotor gyroscopic instruments. Considerable attention is devoted to explaining the physical essence of the gyroscopic phenomena. For a better understanding of the theoretical propositions, the book cites a large number of examples that will aid the reader in familiarizing himself with the subject on his own. Scientists, engineers and technicians concerned with gyroscopic devices will also find this book useful. Author (TAB)

N67-28343# Oak Ridge National Lab., Tenn.

VACUUM PYCNOMETER USING MERCURY WITH PLUNGER DISPLACEMENT FOR HOT CELL USE

S. E. Diemuke and R. L. Stone Feb. 1967 17 p (Contract W-7405-ENG-26) (ORNL-TM-1743) CFSTI: HC $3.00/MF $0.65

An instrument was developed to measure the bulk volume as a step in obtaining the bulk density of porous fuel pellets in a master slave manipulator equipped hot cell. The volume that is actually measured is estimated as that volume bound by the exposed surface of the sample and the area over cracks and pores less than 14 microns wide. Accuracy of this instrument is ±0.0003 cm^3 which is better than accuracy got with submersion weighing of nonporous samples with standard equipment in the hot cells. Volumes of 0.16 cm^3 are measured directly. Measurement time was 40 min per sample. The basic design and important construction details are given with a detailed discussion of the various factors that reduce the ultimate accuracy. Operating procedures and a procedure for filling the pycnometer with mercury are also covered in detail. Author (NSA)

N67-28346# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.
DATA ON MEASURING ELECTRIC RESISTANCE AT 77°K AND 420°K IN GRAPHITES IRRADIATED AT 77°K
E. Bonjour and Pereira B. Da Silva Jul. 1965 17 p In FRENCH; ENGLISH summary
(NP-16530)

The development and construction of an apparatus for measurement of the electric resistivity of graphite samples between 77° and 420°K is described. The device permits thermal annealing for study of the evolution of the electric resistivity during the recovery of salts irradiated by neutrons at 77°K. As examples curves of resistivity variations for anneals normalized to the initial variation of 77°K are given for pulse annealing of 5°K per 150 sec. The anneal profiles obtained are very precise. They show a well-defined substate in the antiannealing region from 120 to 160°K. The precision of the measurements is illustrated by the superposition of curves obtained on three different samples irradiated at identical doses. NSA

N67-28361*# Bell and Howell Research Center, Pasadena, Calif.
A STUDY OF THE INTRODUCTION OF IONS INTO THE REGION OF STRONG FIELDS WITHIN A QUADRUPOLE MASS SPECTROMETER Quarterly Progress Report, 17 May–17 Aug. 1966
Wilson M. Brubaker 17 Aug. 1966 31 p
(Contract NASw-1298)
(NASA-CR-79170; QPR-4) CFSTI: HC $3.00/MF $0.65 CSCL 20F

A theoretical and experimental study of the introduction of ions into the strong fields of a quadrupole mass filter was undertaken. Computer studies were extended to reveal the manner in which the maximum amplitudes of the trajectories are influenced by the length of the fringing field, in periods of the applied ac potentials. Experimental data reveal that the influence of ion injection energy is different for the conventional and the delayed dc modes of operation. The perturbation of the fields within the quadrupole structure by the substitution of round instead of hyperbolic electrode surfaces has been calculated. Selected trajectories have been computed for the perturbed fields. These trajectories depart markedly from those for corresponding hyperbolic quadrupoles. For the general case, limited progress was made in predicting the influence of the field perturbations upon the trajectories. Author

N67-28364# Royal Aircraft Establishment, Farnborough (England).
A SEMIAUTOMATIC EQUIPMENT FOR THE CALIBRATION OF PRESSURE TRANSDUCERS
P. C. Pole–Baker Nov. 1966 24 p ref
(RAE-TR-66352) CFSTI: HC $3.00/MF $0.65

An equipment for the calibration of pressure transducers by a continuous sweep method is described which enables transducers having range maxima between 0.5 and 5000 psi to be calibrated with an overall accuracy better than 0.1% of full scale. The system is shown to have certain advantages over the conventional point-by-point methods of calibration. Author (ESRO)

N67-28398# Air Force Systems Command, Wright-Patterson AFB, Ohio. Flight Dynamics Lab.
AN EVALUATION OF BAKELITE BACKED CONSTANTAN FOIL STRAIN GAGES TO 600°F Technical Report, Mar. 1965–Jul. 1966
Bernard E. Davis Dec. 1966 16 p refs
(AFFDL-TR-66-198; AD-649248) CFSTI: HC $3.00/MF $0.65

This evaluation was conducted in support of an elevated temperature fatigue test program. The measurement of strain at temperatures up to 600F using a 450F rated bakelite backed, constantan foil strain gage is described. This gage was found to be usable up to this temperature. Author (TAB)

N67-28400# Naval Air Test Center, Patuxent River, Md.
INVESTIGATION OF CALIBRATION STANDARDS AND PROCEDURES FOR RF FIELD INTENSITY MEASURING EQUIPMENTS Final Report, Jan. 1965–Apr. 1966
R. S. Trible, T. R. Gardner, and R. E. Metcalfe Griffiss AFB, N. Y., RADC, Feb. 1967 209 p refs *Its* Problem no. 65-17
(RADC-TR-66-687; AD-649374) CFSTI: HC $3.00/MF $0.65

Calibration techniques and instrumentation were investigated to improve RFI measurements to within an accuracy of plus or minus 0.5 db. The results of this study indicate that CW signal generators may be used in conjunction with pin diode modulators to calibrate RFI receivers for narrow band (CW) measurements. Most impulse calibrators will also calibrate RFI receivers for narrow band measurements satisfactorily since they are used primarily as a transfer standard. Both of these calibrating devices have been improved by solid-state circuitry and techniques. It was discovered that most errors in measurements and calibration were within the RFI receivers and limited dispersion spectrum analyzers. Spectrum analyzers have been improved using wide band dispersions (2 GHz) and RFI receivers may be improved by using isolators at the input and using a good peak detecting device with a digital readout. Also a mathematical expression has been derived to determine the amplitude of off-tuned responses in RFI receivers. Author (TAB)

N67-28404# California Univ., Davis. Crocker Nuclear Labs.
DIRECTIONAL CORRELATION ATTENUATION COEFFICIENTS WITH Ge DETECTORS
George A. Carlson 23 Jan. 1967 32 p refs
(Contract AT(11-1)-GEN-10)
(UCD-CNL-74) CFSTI: HC $3.00/MF $0.65

Methods are presented for finding accurate attenuation coefficients for a rectangular Ge detector. The coefficients and the corresponding ones for a cylindrical NaI detector are used in the Legendre polynomial series representing the directional correlation function for the finite solid angles subtended by the detectors. Examples are given for particular cases, and the computer program used in the calculation is included. NSA

N67-28428# Scientific Translation Service, La Canada, Calif.
ON INSTRUMENTAL ERRORS IN THE PRECISION DETERMINATION OF THE ISOTOPIC COMPOSITION OF ELEMENTS
E. M. Galimov, V. A. Grinenko, and V. I. Ustinov 1965 12 p refs Transl. into ENGLISH from Zh. Analit. Khim. (Moscow), v. 20, 1965 p 547–553
(K-TRANS-12)

Two types of errors are discussed. The errors of the first group were caused by accidental fluctuations of the mass spectrometer characteristics. These errors were estimated by means of statistics. The errors of the second group occurred due to the variation of conditions when measurements were carried out at different times, fluctuations of the temperature, humidity, background conditions, zero drift, etc. By means of formulas obtained analyses of experimental errors were made, and the results were given in two tables. The errors considered have a decisive influence on the reproducibility of the isotopic analysis. Author (NSA)

N67-28451# United Kingdom Atomic Energy Authority, Harwell (England). Atomic Energy Research Establishment.
A SEMI-AUTOMATIC DEVICE FOR SCANNING AND MEASURING SPARK CHAMBER PHOTOGRAPHS
F. Legar, M. Maly, and O. Shon Feb. 1966 34 p Transl. into ENGLISH of Joint Inst. for Nucl. Res., Dubna, USSR Rept. No. JINR-P-2340, 1965
(NP-TR-1416; JINR-P-2340)

A semi-automatic device for scanning and measuring the spark chamber photographs was developed and constructed. The device has the following technical characteristics: it is meant for

measuring the angles of track deflection on the photographs taken with standard 35-mm motion picture cameras, the magnification on the screen is tenfold, the device is provided with a black screen which allows to work by daylight, the film is automatically driven, the device has two regimes for driving the film: frame by frame and continuous, forward and backward, and the device records automatically the angular coordinates on the paper tape. Author (NSA)

N67-28508# Battelle Inst., Frankfurt am Main (West Germany).
BASIC RESEARCH INTO THE FRICTION BETWEEN NON-LUBRICATED SOLID BODIES INCLUDING ELEVATED TEMPERATURES Final Report, Jan.–Dec. 1964
G. Bohme, G. Sperling, and H. Krupp Wright-Patterson AFB, Ohio, AF Mater. Lab., Jan. 1967 108 p refs
(Contract AF 61(052)-745)
(AFML-TR-64-418; AD-649550) CFSTI: HC $3.00/MF $0.65

A review is given of the design and construction of a mechanically driven ultracentrifuge and of the measurements performed with this device. The reasons for discontinuing the work with this centrifuge are discussed. A newly built ultracentrifuge with transistorized drive is described; several systems for heating the rotor are shown. First measurements with this centrifuge and measuring results are described. The theoretical investigations of the separation of small particles from a solid body are based on the known laws for sinter and creep processes at elevated temperatures; they lead to an expression for the dependence of the creep rupture time on the experimental variables. The elasticity calculations furnished rigorous solutions for the vertical and tangential displacement of an elastic semi-infinite body under the action of an external pointshaped center of attraction. For the deformation of the elastic semi-infinite body by the action of an external spherical center of force with attractive and repulsive forces approximate solutions can be proposed. The appendix deals with the solution of boundary value problems of elastostatics in general and for the specific case of the elastic sphere and the elastic semi-infinite body by methods of the potential theory. Author (TAB)

N67-28540# Bonn Univ. (West Germany). Institut fuer Strahlen- und Kernphysik.
AN APPARATUS FOR THE MEASUREMENT OF GAMMA–GAMMA-LINEAR POLARIZATION CORRELATIONS [EINE APPARATUR ZUR MESSUNG VON GAMMA–GAMMA LINEARPOLARISATIONS RICHTUNGSKORRELATIONEN]
H. Huebel Nov. 1966 66 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Wiss. Forschung., Bad Godesberg, West Germany.
(BMWF-FBK-66-37)

A survey of the results of the theory of gamma–gamma angular correlations and gamma–gamma linear polarization correlations are given. The Compton effect is used for the measurement of the linear polarization of gamma rays. The nine-detector apparatus employed, the analysis of the data, and the calibration of the apparatus by measurements on ^{60}Co and ^{46}Sc, as well as the calculation of the asymmetry ratio, R, are described. The parity of the 1543-keV level in ^{168}Er was determined. Author (NSA)

N67-28550# Utah Univ., Salt Lake City. Upper Air Research Lab.
ELECTROMAGNETIC MEASUREMENTS OF ACCELERATION
Dietrich K. Gehmlich Nov. 1966 36 p refs
(Contract AF 19(628)-4055)
(SR-2; AFCRL-66-799; AD-651161) CFSTI: HC $3.00/MF $0.65

The most common types of accelerometers are examined to determine their suitability for measuring drag accelerations in the falling sphere air density experiment. Only those types having no mechanical friction can detect the low drag accelerations encountered at high altitudes. One type of frictionless accelerometer, having electromagnetic suspension, is considered in some detail. The ultimate goal is the development of a three-axis accelerometer with a single, spherical proof-mass common to all three axes which can detect drag accelerations down to 0.00001 or 0.000001 g. Author (TAB)

N67-28609# Army Electronics Labs., Fort Monmouth, N. J.
MICROWAVE DETECTORS USING HOT CARRIER EFFECTS
Frank A. Brand, Wesley G. Matthei, Joseph J. Baranowski, and Ivan L. Chase Feb. 1967 34 p refs
(ECOM-2797; AD-651023) CFSTI: HC $3.00/MF $0.65

A new class of solid state microwave detectors based upon the hot carrier properties of majority carriers in germanium has been recently described by Harrison and Zucker. Hot carrier detectors are based upon the nonequilibrium carrier distribution which results when an incident microwave field accelerates the free carriers so that they acquire more energy than the lattice in which they reside. These hot carriers, out of equilibrium with the lattice, give rise to a thermoelectric voltage which is proportional to the incident R.F. field. This report describes the design, fabrication, and performance of hot carrier detectors using high resistivity silicon and bonded point contacts. Direct-current characteristics as well as R.F. properties in the range from 1-10 GHz are described. Of particular interest are power sensitivity, dynamic range, and power handling capability. Author (TAB)

N67-28615# Forest Products Lab., Madison, Wis.
MEASURING SURFACE IRREGULARITIES IN PANEL PRODUCTS
B. G. Heebink Apr. 1967 4 p Prepared in cooperation with Wisconsin Univ.
(FPL-0159; AD-651125) CFSTI: HC $3.00/MF $0.65

A method was developed which permits an approximate measurement of vertical deformations in wood panel surfaces. A narrow slit of bright light is directed at a tightly stretched wire so as to cast a shadow on an inclined test surface. A photograph, taken from directly above, reveals any irregularities by the form of the shadow so cast. TAB

N67-28654*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
INSTRUMENTATION
In its Res. and Advanced Develop., Vol. II 31 Jan. 1967 p 281–307 refs (See N67-28641 15-34)

Image sensors are being evaluated; as are devices such as return beam and sterilizable hyper-ruggedized vidicons that are unique to space photography. Advanced signal conditioning electronic circuits are being considered for applications in planetary capsule instruments and the next generation of spacecraft astrophysical instruments. Quantitative use of imaging systems, test instrument development, radiometry instrumentation development, and electron microscope modification are also reported. M.W.R.

N67-28684# Ballistic Research Labs., Aberdeen Proving Ground, Md.
TEMPERATURE STABILITY OF A STILBENE SPECTROMETER
James G. Dante Nov. 1966 26 p refs
(BRL-MR-1808; AD-650088) CFSTI: HC $3.00/MF $0.65

A stilbene spectrometer will be used to measure neutron and gamma ray spectral distribution and intensity during Project HENRE at the Nevada Test Site. Daily temperature changes of from 30 to 40 degrees are expected. The report presents the results of an investigation of changes in the entire spectrometer system due to variations in temperature. Changes in time of output pulses and gain of the entire system were observed over a temperature range of 12 degrees F to 132 F. TAB

N67-28885# Ballistic Research Labs., Aberdeen Proving Ground, Md.

A COMPARATOR CALIBRATION METHOD

Heinz G. Poetzschke Jan. 1967 28 p *ref*

(BRL-R-1353; AD-650087) CFSTI: HC $3.00/MF $0.65

A method is described for calibrating precision comparators by using grid plates which have been calibrated by means of a triangulation method based exclusively on distance measurements. The method used for calibrating the grid plate provides measurements of the x, y coordinates for selected grid intersections to an accuracy better than plus or minus 1 micron. Using calibrated grid plates, the comparator may be calibrated to determine instrument constants such as: (1) Overall scalers of the measuring screws. (2) Non-orthogonality between the x and y movements. (3) Translation and rotation between grid and comparator coordinate systems. The results of a number of calibrations are shown. Author (TAB)

N67-28784*# California Univ., Berkeley. Space Sciences Lab.

A STUDY OF ADVANCED INFRARED DETECTORS FOR USE IN PLANETARY SPECTROSCOPY Semiannual Report, 1 Oct. 1966–31 Mar. 1967

Harold Weaver 31 Mar. 1967 27 p refs *Its* Lab. Ser. No. 8, Issue No. 46

(Grant NsG-707)

(NASA-CR-84824) CFSTI: HC $3.00/MF $0.65 CSCL 14B

A summary is given of the continuing research on bolometer fabrication and measurements. The measurements discussed include characterization of germanium resistance vs temperature curve, and measurements using the Texas Instruments Dewar and a glass Dewar. The characteristics of field effect transistors for low noise amplifiers at low and medium frequencies are reviewed, and the possibility of using parametric amplifiers to alleviate the problem of 1/f noise is discussed. N.E.N.

N67-28825*# ARACON Geophysics Co., Concord, Mass.

ARACON PHOTOGRAMMETRIC ATTITUDE SYSTEM HARDWARE DESCRIPTION AND MAINTENANCE MANUAL

Robert P. Bartlett Jul. 1965 67 p refs

(Contract NAS5-3953)

(NASA-CR-84841; Rept.-968-13) CSCL 22C

A flexible photogrammetric satellite attitude determination system was developed. System hardware is a general-purpose film reader along with formatting and control electronics. Off-line operation of this equipment produces a paper tape filled with raw attitude data. Computer programs have been provided to calculate TIROS attitude parameters with the aid of a Control Data 160-A. The paper tape produced by film reader operation contains several varieties of data, some numerical and some not. The primary numerical data are X–Y coordinates of three different types of data "points": landmarks, horizon points, and matchpoints (common features in pictures with overlapping coverage). These data are obtained by reading the positions of cursors centered by an operator over selected image points of cloud pictures displayed on the film reader. Author

N67-28830# Naval Ordnance Lab., White Oak, Md.

BOND INSPECTION BY SCANNING IMAGES IN SCINTILLATING CRYSTALS

Charles H. Dyer, Edward L. Criscuolo, and Daniel Polansky 15 Mar. 1967 22 p refs

(NOLTR-67-36; AD-650878) CFSTI: HC $3.00/MF $0.65

Characteristics of filmless methods of bond inspection for large diameter motors are presented. High energy radiation after traversing the bond area of a motor impinges on a sodium iodide crystal, which transforms the radiation intensity into a light pattern. This image on the crystal is scanned with an optical scanning system. A photomultiplier converts the light to an electrical signal, which is then displayed on an oscilloscope. Limitations of the system due to the relatively poor image formation ability of a scintillating crystal are given. Data are presented on detectable slit sizes using a 10 MeV betatron and 14 inches of low atomic number materials. Author (TAB)

N67-28841# United Kingdom Atomic Energy Authority, Harwell (England). Chemistry Div.

A TRANSPIRATION APPARATUS FOR MEASURING VAPOUR PRESSURES—THE VAPOUR PRESSURE OF GOLD

B. A. Philips and M. H. Rand Feb. 1967 23 p refs

(AERE-R-5352) HMSO: 3s 6d

An apparatus is described for the measurement of vapor pressures of plutonium compounds by the transpiration technique. A measured volume of helium is passed over the inductively-heated sample, whose weight loss is determined. The vapor pressure of liquid gold, which has been measured in this apparatus, is given by the equation $\log p(atm) = 5.840 - 18.009/T$ over the temperature range 1723 to 2142°K. The results give a value of $87.94 \pm 0.3_3$ kcal for the heat of sublimation of gold (to monatomic vapor) at 25°C. Author

N67-28854# United Kingdom Atomic Energy Authority, Harwell (England). Health Physics and Medical Div.

DETECTION OF HIGH BETA-RAY DOSE RATES WITH A SIMPLE DETECTOR

A. K. Burt and J. A. B. Gibson Jan. 1967 8 p refs

(AERE-M-1830) HMSO: 1s 9d

A simple instrument has been developed to measure beta-ray dose rates above 1 rad/h (in tissue) and contamination levels greater than 0.04 nCi/cm^2. This detector has been used in contamination control of high activity handling cells. The rate of energy deposition ($\frac{dE}{dx}$) is measured in 0.010 inch of plastic phosphor (NE 102A) with a simple photodiode to detect the light output. The instrument has also been used to determine surface activity by using a plastic collimator to define a fixed area for measurement. The range of the instrument is from 2 to at least 25,000 rad/h (in tissue). The gamma-ray response is small below 100 R/h and is a linear function of dose rate above this level. The instrument is essentially tissue equivalent (±20%) above about 0.15 Mev (electron energy). Author

N67-28855# United Kingdom Atomic Energy Authority, Culham (England). Research Group.

A POTASSIUM BEAM PROBE FOR THE MEASUREMENT OF ELECTRON DENSITY

J. W. Hill, D. W. Mason, and A. Trauis 1967 9 p refs

(CLM-R-68) HMSO: 1s 2d

An apparatus for the production and detection of a beam of mono-energetic potassium atoms is described. By measuring the attenuation of this beam on its passage through a plasma, electron densities may be evaluated. Since the beam velocity exceeds 10^7 cm sec^{-1} rapid changes in density may be observed. This technique has been applied to the plasma produced by a plasma gun, and compared with simultaneous microwave interferometer measurements. Author

N67-28859# United Kingdom Atomic Energy Authority, Harwell (England). Electronics and Applied Physics Div.

THE FEASIBILITY OF OPTICAL WRITING AND READING ON MAGNETIC AND OTHER RECORDING MEDIA

E. Franklin Jan. 1967 31 p refs

(AERE-R-5003) HMSO: 5s 6d

The feasibility of achieving high information packing density on recording tape by the use of optical write and read methods is discussed. The principal recording medium considered is magnetic metal film, but some attention is given to a number of other possible media. It is concluded that magnetic film appears the most promising at present. This note is circulated as a basis for

discussion on the extent of the need for high density tape recording and on the worthwhileness of initiating work along the lines indicated in order to achieve it. Author

N67-28872# Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex.
DESIGN AND CALIBRATION OF A MODIFIED CONIFUGE
M. I. Tillery Jan. 1967 30 p refs
(Contract AT(29-2)-1013)
(LF-34) CFSTI: HC $3.00/MF $0.65

A modified centrifugal sampling instrument for airborne particulates of the type developed by Sawyer and Walton is described. The modifications permit controlled introduction of clean air and a method of collecting the sample on electron microscope grids for examination. Construction details of the modifications are included. Experimentally determined calibration curves for 3000, 4000, and 5000 rpm are given, together with electromicrographs of typical deposits. Author (NSA)

N67-28873# Stanford Univ., Calif. Linear Accelerator Center.
INSTRUMENTATION, COMPUTER CONTROL AND ELECTRONIC SYSTEMS FOR THE SLAC BEAM SWITCHYARD
D. A. G. Neet, ed. Oct. 1966 30 p refs
(Contract AT(04-3)-400)
(SLAC-68) CFSTI: HC $3.00/MF $0.65

Functional descriptions are given of various switchyard systems. Information of a more general nature is also included. Topics discussed include instrumentation for the beam switchyard; general design considerations; beam current monitoring; beam position monitoring; beam profile monitoring; secondary emission foil monitors; beam spectrum instrumentation; magnetic measurement instruments; controls for magnets, slits, and collimators; computer system; equipment protection in the switchyard; and beam switchyard control room. NSA

N67-28890# Naval Ordnance Lab., White Oak, Md.
THE BEHAVIOR OF TANDEM AND PARALLEL DETECTOR COILS OF MAGNETIC GRADIOMETERS IN THE FIELD OF A MAGNETIC DIPOLE
O. J. Van Sant 6 Feb. 1967 43 p
(NOLTR-66-224; AD-649279) CFSTI: HC $3.00/MF $0.65

Expressions for the signals from tandem and parallel detector coils of magnetic gradiometers in the field of a magnetic dipole are derived and compared with experiment. The maximum and minimum signals are theoretically and experimentally examined and results are shown of calculations of the possible paths one can follow to obtain maximum and minimum signals. The significance of measurements made by the detector coil configurations is discussed in conclusion. Author (TAB)

N67-28931*# Texas Instruments, Inc., Dallas. Apparatus Div.
SPACE PROBE RADAR ALTIMETER STUDY Final Technical Report, Volume 1, Mar.–Dec. 1966
Dec. 1966 136 p refs
(Contract NAS1-5954)
(NASA-CR-66383) CFSTI: HC $3.00/MF $0.65 CSCL 17G

Several modulation techniques (FM/CW, ICW, Pulse) for a radar altimeter used on a planetary lander are compared for feasibility, accuracy, size, weight, sterilizability, etc. Because of the large entry velocities (and correspondingly large Doppler frequency shifts) and the large attitude variations of the vehicle in the proposed mission, an all solid-state, pulsed altimeter with an electronically steerable antenna beam is recommended. A detailed design of a pulsed system using microwave integrated circuits is included. It utilizes a phased array of radiators to develop the beam steering, and pulse leading edge range tracking to achieve the required accuracy. The output is an 11-bit digital word. Author

N67-28932*# Texas Instruments, Inc., Dallas. Apparatus Div.
DEVELOPMENTAL PLAN FOR THE DESIGN, DEVELOPMENT, AND PRODUCTION OF A SPACE PROBE ALTIMETER Final Technical Report, Volume 2, Mar.–Dec. 1966
Dec. 1966 48 p refs
(Contract NAS1-5954)
(NASA-CR-66384) CFSTI: HC $3.00/MF $0.65 CSCL 17G

The development plan encompasses the project planning network, manufacturing, environmental tests, flight test qualifications facilities, and project funding. Manufacturing will be on a model shop basis or will be done in a short run production facility within the main fabrication shop. The assembly and testing of the altimeter will be conducted in a horizontal laminar flow cleanroom. For additional testing, government facilities will be required to perform certain tests for which facilities are not available, or for tests which require testing in conjunction with other assemblies and/or the probe/lander itself. For flight test qualifications, a balloon drop has been shown to be the most feasible method for additional tests of the altimeter. Other test facilities are discussed and a budgetary estimate of cost of developing, testing, and delivering a maximum of ten radar altimeters was made. Author

N67-28933*# Texas Instruments, Inc., Dallas. Apparatus Div.
RELIABILITY AND QUALITY ASSURANCE PLAN FOR THE DESIGN, DEVELOPMENT, AND PRODUCTION OF A SPACE PROBE ALTIMETER Final Technical Report, Volume 3, Mar.–Dec. 1966
Dec. 1966 64 p refs
(Contract NAS1-5954)
(NASA-CR-66385) CSCL 17G

A detailed conceptual design for an all solid state space probe radar altimeter has been developed. A preliminary reliability and quality assurance plan for the altimeter is presented. A current reliability estimate of the design is included. The probability of successful operation of the altimeter during a one-half hour letdown to landing on Mars is estimated to be 0.999982. Author

N67-28948# Wisconsin Univ., Madison. Dept. of Meteorology.
REMOTE SENSING BY INFRARED AND MICROWAVE RADIOMETRY I. BASIC PRINCIPLES II. A TECHNIQUE FOR THE CORRECTION OF AIRBORNE MEASUREMENTS OF APPARENT SURFACE TEMPERATURE OF NATURAL WATER BODIES III. POTENTIAL APPLICATIONS OF INFRARED AND MICROWAVE RADIOMETRY
Velayudh Krishna Menon and Robert A. Ragotzkie Feb. 1967 66 p refs
(Contract Nonr-1202(7))
(TR-31; AD-651188) CFSTI: HC $3.00/MF $0.65

The basic principles involved in the remote sensing by passive techniques in the infrared to microwave region of the electromagnetic spectrum are discussed. Whereas the radiation below ten micron wavelength has found distinct application in many fields, the region between 0.1 to 10 cms has a decided advantage in situations where the atmospheric constituents interfere. Consideration is then given to the specific problem of atmospheric interference in the 8 to 14 micron wavelength region due to water vapor and carbon dioxide. A technique for correcting radiometric measurements of surface temperatures for interference by these two constituents is suggested. The final portion deals with the potential applications of infrared and microwave radiometry to the measurement of surface temperature of natural water bodies, horizontal temperature gradients, and the heat flux across the sea-air interface. The relative advantages of infrared and microwave techniques are compared. Author (TAB)

N67-28950# Army Materials Research Agency, Watertown, Mass.
DIFFERENTIAL ULTRASONIC SPECTROSCOPY FOR DEFECT AND MICROSTRUCTURE IDENTIFICATION

Otto R. Gericke Mar. 1967 19 p refs
(AMRA-TR-67-07; AD-650787) CFSTI: HC $3.00/MF $0.65

The report presents improved experimental procedures for ultrasonic spectroscopy which make it possible either to compare the spectra of two ultrasonic echo signals or to obtain a curve representing differences in the spectral amplitude distribution of these signals. It is shown that the differential method can be used to distinguish two defects from each other which, although differing in size, produce indications of identical height in an ordinary pulse-echo test. It is further shown that the new spectroscopic technique can be used to determine differences in the microstructure of materials if these differences affect the attenuation of ultrasound.
Author (TAB)

N67-28961# Texas Western Coll., El Paso. Schellenger Research Labs.
RESPONSE TIME OF THE EFFECTS OF RADIATION ON THE VECO BEAD THERMISTOR
Harold N. Ballard Aug. 1961 46 p refs
(Contract DA-29-040-ORD-2410)
(AD-645050) CFSTI: HC $3.00/MF $0.65

Experimental tests were performed on VECO bead thermistors coated with Krylon Glossy White No. 1501 Spray Enamel, carbon black, and aluminum. Tests were run in an environmental testing chamber at pressures of 670, 87, 8, and 1 mm Hg, corresponding to altitudes of 4,000, 50,000, 100,000, and 150,000 ft respectively. Temperatures were varied between +20C and -70C at each of the above pressures, reproducing as nearly as possible the environmental conditions expected during the descent of a parachute-supported temperature telemetry system. It was found, however, that radiation from the walls of the test chamber prevented the thermistor from reaching an equilibrium temperature with the surrounding air. Thermocouples placed within the test chamber to monitor the temperature of the air behaved in the same way, i.e., failed to reach equilibrium temperature with the air. To determine the air temperature, an acoustic thermometer was devised. Air was circulated in the chamber at a velocity of 132 ft/min during the tests. This velocity was determined at 670 mm Hg. TAB

15 MACHINE ELEMENTS AND PROCESSES

Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control, and reliability; drafting; and materials fabrication, handling, and inspection.

N67-27961# Frankford Arsenal, Philadelphia, Pa. Pitman-Dunn Research Labs.
FRICTION STUDIES OF POLYMER SOLUTIONS
Henry Gisser and Marco Petronio *In* Army Dept. Proc. of the 1966 Army Sci. Conf., Vol. I 26 Aug. 1966 p 347–360 refs
(See N67-27941 15-34)
(AD-634682)

Friction behavior of vinyl polymers in solution were studied with both polarity and length of chain on the side group varied, and coefficient of friction was determined on a modified Bowden-Leben machine in which the tangential force was detected by strain gauges mounted on a strain ring. The poly(n-alkyl methacrylate)s were prepared by emulsion polymerization with alkyl groups varying from C1 to C22. Alkyl group length in the polymer side chain is found to have both quantitatively and qualitatively the same effect as friction reduction of a small molecule. Further, as concentration was increased, the coefficient of friction also increased; although the coefficient tended to reach a plateau at higher concentrations. This may indicate that the effectiveness of the long chains is masked by increasing film thickness. Polarity density of the polymers was also considered.
M.W.R.

N67-28019*# Chrysler Corp., New Orleans, La. Space Div.
TEST REPORT FOR PRESSURE SWITCH SIGMA-NETICS, INC. PART NUMBERS 704011, 704012, 704013, 704024, 704025, AND 704026
8 Feb. 1967 60 p
(Contract NAS8-4016)
(NASA-CR-84664; TR-RE-CCSD-FO-1029-3) CFSTI: HC $3.00/MF $0.65 CSCL 13G

Results of tests performed on 16 pressure switches are presented. The following tests were performed: receiving inspection, proof pressure, functional, low temperature, salt fog, explosion, seal leakage, and life cycle. Five of the eight specimens were subjected to a low temperature environment. The specimens did not function satisfactorily during the low temperature test. A vendor representative cleaned, lubricated, and reset the specimens, and the test was then repeated. The specimens again failed to function properly during the test, therefore all eight test specimens were dropped from the test program. Four of the eight specimens failed to function properly after being subjected to a salt fog environment for 10 days. Three of the salt fog test specimens were cleaned, lubricated, and reset prior to a life cycle test. Six of the test specimens which were subjected to a life cycle test did not function satisfactorily during all of the functional tests.
Author

N67-28197# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DETERMINATION OF STRESSES IN THE PROCESS OF FORCED PRECISION PRESSING OF PARTS
B. P. Stenko 19 Jan. 1967 16 p refs Transl. into ENGLISH from Tr. Kazansk. Aviats. Inst. (Kazan), no. 84, 1964 p 85–94
(FTD-MT-66-138; TT-67-61356; AD-649041) CFSTI: HC $3.00/MF $0.65

Considerations in determining stresses occurring in the process of forced rotational pressing of precision parts are developed. Emphasis is placed on determining the effect on the process of such parameters as V - the rate of rotation, S - the feed rate, f - the press coefficient, and others. The resultant stress P is the product P = q.f, where q is the mean unit tool pressure, and F is the contact area between the tool and the part. This product may be written in a form suited to defining stress components as related to area projections on coordinate planes. A method of determining the projected areas of contact surfaces for press rollers with conical radial profiles is developed. Circumferential deformations are ignored as radial and longitudinal distortions are emphasized. Geometrical equalities for an example case are given. Special testing equipment was designed and constructed for studying the process. The equipment consisted of a dynamometer with a press roller, a press mandrel, and instrumentation. Each major component of the test equipment is described. The system was tested and checked out with the preparation of a roller of U8A steel. Some details of temperature-measuring instrumentation are given.
Author (TAB)

N67-28200# Marine Engineering Lab., Annapolis, Md.
DEVELOPMENT OF A QUIET VANELESS IMPELLER CENTRIFUGAL PUMP
John W. Henry and Stephen Rae Mar. 1967 145 p refs
(MEL-221/66; AD-649577) CFSTI: HC $3.00/MF $0.65

In the search for a quiet centrifugal pump, a vaneless impeller, consisting of a disk of porous material bonded between impeller shrouds, is being developed to eliminate vane-frequency noise. The porous impeller is unique in that it requires no vanes or discrete fasteners which may generate rotational-related, pure-tone noise.

A theoretical analysis, conducted to predict performance of the porous impeller with given configuration, speed, and flow was experimentally confirmed. Hydraulic and acoustic characteristics of the porous impeller and a conventional vaned impeller were compared in extensive laboratory tests. The porous impeller has no vane frequency, and yields overall pump efficiencies of about 77 percent of those obtained with the conventional rotor. Author (TAB)

N67-28242# Rock Island Arsenal Lab., Ill. Research and Engineering Div.

LUBRICITY CHARACTERISTICS OF CORROSION PREVENTIVE OILS

Charles J. Quilty Dec. 1966 26 p refs

(RIA-66-3514; AD-649098) CFSTI: HC $3.00/MF $0.65

In the study, seventeen qualified preservative oils were investigated to establish their lubricity properties. The oils were tested in a Shell Four-Ball Wear Tester at selected loads and the wear scars measured. The viscosity and acidity of each oil were determined before and after wear test. Adhesive wear particles formed during wear tests were examined microscopically and their size shown to be an indication of the lubricating ability of the oil. Results indicate that these oils leave considerable room for improvement in their lubricating ability. A new method, using thermometric titrimetry, was developed for determining acidity in new and used corrosion preventive and lubricating oils. The total acid numbers obtained by colorimetric, potentiometric, and thermometric methods were compared. Author (TAB)

N67-28246# Marine Engineering Lab., Annapolis, Md.

A STUDY OF HOT CRACKING IN WELDED HIGH-STRENGTH STEELS USING THE VARESTRAINT TEST

R. E. Thompson Mar. 1967 49 p refs

(MEL-13/67; AD-649137) CFSTI: HC $3.00/MF $0.65

Hot cracking of HY-130/150 steel and a rare-earth-treated HY-80 steel during welding was investigated with the Varestraint test apparatus, a device which permits independent variation of welding conditions and restraint. The test involves depositing a weld bead and simultaneously applying an instantaneous bending load. The susceptibility of a material to hot cracking is determined from the resulting amount of cracking. Two welding processes were used on thin plate specimens: tungsten-inert-gas without filler, and metal-inert-gas. Results showed that the amount of hot cracking varied with welding conditions, plate thickness, and applied strain. The data indicated HY-130/150 to be more resistant to cracking than HY-80. Cracking occurred at solute-enriched grain boundaries, but not at substructure boundaries. Segregation and structural features of boundaries were found to be important factors associated with hot cracking. Examination of the metal-inert-gas welds revealed evidence of capillary diffusion of solute into hot cracks. TAB

N67-28247# Marine Engineering Lab., Annapolis, Md.

NOISE CHARACTERISTICS OF A FRICTIONAL FOUR-WAY SERVO VALVE

Robert A. Wright Feb. 1967 37 p refs

(MEL-55/67; AD-649067) CFSTI: HC $3.00/MF $0.65

A four-way, hydraulic, servo valve was evaluated for structureborne noise. It utilized the frictional throttling method developed by MEL. The highest broad-band noise level was 89 acceleration decibels with 37 gallons per minute of 140 Fahrenheit Type 2190-TEP, hydraulic fluid, flowing through the valve at a 1000 pound per square inch pressure drop. Under similar conditions, it was 30 acceleration decibels quieter than a conventional, orificial-type servo valve. Author (TAB)

N67-28257# Army Edgewood Arsenal, Md. Pre-Production Evaluation Div.

VACUUM (OR FLUXLESS) BRAZING-GAS QUENCHING OF 6061 ALUMINUM ALLOY

Melvin M. Schwartz (Martin Co.), Francis B. Gurtner, and Paul K. Shutt, Jr. Mar. 1967 41 p

(EATR-4085; AD-649313) CFSTI: HC $3.00/MF $0.65

An investigation was made to provide a process or method for producing helium leak-tight containers under controlled processing and therefore with a high level of compatibility. The concept evolved around combining vacuum brazing and gas quenching into one operation. The parts were quenched in the furnace after brazing or solution treating. The advance into the field of vacuum brazing-gas quenching has provided a definite advance in the field of manufacturing for high or low volumes of items. As a result of the investigation, the following conclusions were drawn: (1) Vacuum brazing-gas quenching is feasible for production quantities of complex and simple items. (2) The application of such a process is not limited to 6061 aluminum, but can be extended to ferrous and nonferrous alloys. (3) The future for a process such as vacuum brazing-gas quenching is unlimited at the present time. Author (TAB)

N67-28261# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

DEVICE FOR EXCITATION OF TORSIONAL SINUSOIDAL OSCILLATIONS

A. T. Bolgov and V. V. Makarov 23 Jan. 1967 7 p Transl. into ENGLISH from Russian Patent No. 172521 (Appl. No. 837629/25-28, 22 May 1963) 2 p

(FTD-HT-66-703; AD-649406) CFSTI: HC $3.00/MF $0.65

The Author Certificate presents a device for exciting sinusoidal oscillations in a system having a rotary shaft. The device contains an electric motor coupled to one end of the rotary shaft to rotate it. To broaden the limits of oscillation control in frequency and amplitude while preserving the sinusoidal form, the device is provided with a three-stage gyroscope. One of the gyroscope frame axes is coupled mechanically to the other end of the rotary shaft of the system. The second frame is provided with an independent electric drive to rotate it and is coupled kinematically, e.g., by a system of gears, to the axis of the inner third frame on which the gyroscope rotor is mounted. Author (TAB)

N67-28265# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

A METHOD OF OBTAINING VACUUM-TIGHT CERMET JOINTS [SPOSOB POLUCHENIYA VAKUUMPLOTNYKH METALLOKERAMICHESKIKH UZLOV]

A. Ya. Makarkin and I. I. Metelkin 23 Jan. 1967 6 p Transl. into ENGLISH from Russian Patent No. 175865 (Appl. no. 774916/29-14, 19 Apr. 1962) 1 p

(FTD-HT-66-711; AD-649412) CFSTI: HC $3.00/MF $0.65

A method is presented for obtaining vacuum-tight cermet junctions by first metallizing the ceramics and then soldering with hard solders. To avoid destroying the metallized layer, to simplify the technique, and to lower the temperature of paste infusion, soldering is carried out directly along the metallized layer formed by the infusion of molybdenum-manganese paste. Author (TAB)

N67-28270# Army Weapons Command, Rock Island, Ill. Research and Engineering Div.

THE ROLE OF ACIDITY AND BASICITY OF A GREASE IN RELATION TO ITS EFFECTIVENESS AS A LUBRICANT AND CORROSION INHIBITOR

Joseph M. Bish Feb. 1967 27 p refs

(RIA-TR-67-342; AD-649103) CFSTI: HC $3.00/MF $0.65

A series of twenty four greases were selected for this work. Eight of the greases were commercial greases selected from a

variety in use today. Eight other greases were made up from an uninhibited calcium hydroxy stearate grease with various combinations of extreme pressure agents, anti-oxidants and rust inhibitors as additives. Eight greases were also prepared from uninhibited MIL-G-10924B grease and the same combination of additives used in the preparation of the calcium hydroxy stearate greases. Acid numbers were determined by the Rock Island Arsenal Method, Fed. Std. 791a-5105.3, ASTM D-974, ASTM D-974 modified, and ASTM D-664. There was a wide variation in the acid and base number obtained by these methods, indicating that each method measures a different property of the grease. Wear and oxidation tests made on the greases were the Shell Four Ball Wear, Falex Rate Wear, Copper Corrosion, Oxidation Stability, and Rust Preventive Properties of Lubricating Greases. It was found that a high acid number does not always indicate poor wear or poor oxidation stability. Both molybdenum dibutyldithiocarbamate and the additive containing molybdenum, sulfur, and phosphorus, when added to the two uninhibited greases gave an increase in acid number and a decrease in wear scar. Author (TAB)

N67-28271# Army Weapons Command, Rock Island, Ill. Research and Engineering Div.

LOAD AND TEMPERATURE AS RELATED TO SOLID FILM LUBRICANT WEAR LIFE

George Murphy, Jr. Jan. 1967 30 p refs

(RIA-TR-67-214; AD-649102) CFSTI: HC $3.00/MF $0.65

A representative solid film lubricant for each specification, MIL-L-8937(ASG), MIL-L-46009(MR) and MIL-L-46010(MR), was evaluated on the Falex Wear Tester under various combinations of test load and temperature. Based on a statistical analysis of the data the following conclusions can be made (1) The effect of temperature on wear life depends on both solid film lubricant type and test load. (2) The wear life of heat cured solid film lubricants is decreased by increased temperature at the lower test loads. The wear life of air cured solid film lubricants is affected very little by temperature. (3) The effect of load on wear life is dependent on lubricant type but not on temperature. (4) For heat cured solid film lubricants a constant short wear life under high loads occurs followed by a rapid increase in wear life with decreasing load and finally a leveling off of wear life with further decreasing of the load. (5) For the air cured solid film lubricant there is a constant short wear life over an extended load range followed by a rapid increase in wear life with a further decrease in load. Over the load range used there is no apparent leveling off of wear life under the low load condition. Author (TAB)

N67-28275# Michigan Univ., Ann Arbor. Inst. of Science and Technology

STUDY OF ALUMINA CRYSTAL STRUCTURES. AUTOMATION OF THE VERNEUIL PROCESS Final Report, 1 May–31 Oct. 1965

F. A. Reiss Bedford, Mass., AFCRL, Mar. 1967 25 p refs

(Contract AF 19(628)-423)

(Rept.-5113-18-F; AFCRL-67-0148; AD-649161) CFSTI: HC $3.00/MF $0.65

A careful analysis of the basic mechanisms of the verneuil process led to a methodical study of the many parameters associated with it. Among these, the powder feed rate, boule retraction rate, and flame characteristics were found to be most important. A photoelectric cell was used to sense the plane of crystallization and control its position by means of a servosystem with two outputs, one controlling the retraction rate and the other the powder feed rate. A completely automated verneuil apparatus, incorporating this and other control systems, was designed and constructed to study crystal growth under well defined, rigidly controlled and dependably reproducible conditions. Author (TAB)

N67-28377*# Chrysler Corp., New Orleans, La. Space Div.

PNEUMATIC FILTER, 1/2-INCH PERMANENT FILTER CORPORATION PART NUMBER 10011-P-5/15, NASA DRAWING NUMBER 75M04406 PF-3 Test Report

A. Pastor 28 Nov. 1966 50 p

(Contract NAS8-4016)

(NASA-CR-84754; TR-RE-CCSD-FO-1098-3) CSCL 13G

Results are presented of the following tests: (1) Receiving Inspection, (2) Proof Pressure, (3) Functional, (4) Flow, (5) Dirt Holding and Collapse Pressure, and (6) Burst. The specimen performance was in accordance with the specification requirements throughout the test program with exception of the micron rating which was determined to be 26.7 microns as opposed to the specification requirement of 10 microns. Author

N67-28384# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

EFFECT OF RADIAL CLEARANCE ON JOURNAL STABILITY IN GAS-LUBRICATED BEARINGS

G. A. Pospelov 20 Dec. 1966 15 p refs Transl. into ENGLISH from Tr. Aviats. Inst. Kazan (USSR), no. 81, 69–80

(FTD-TT-65-1404; TT-67-61332; AD-649033) CFSTI: HC $3.00/MF $0.65

In investigations of stability, the assumption that the reaction of the oil film is independent of the speed of the center of the journal is frequently employed. The author solved the problem of determining the forces in a gas film, which arise in the case of disturbed journal movement. The circumferential components of these forces are determined on the basis of the expression for the determining factor of the gas lubricant. The radial components are computed by an approximate solution of the differential equation describing the forward motion of the journal. The Trefts method is used in the solution. After substitution of the forces in the motion equation, a characteristic equation is written, which is studied for stability by the Raus-Gurvits method. An instability zone boundary diagram is presented in 'dimensionless eccentricity load angle' coordinated. TAB

N67-28431# Dilworth, Secord, Meagher and Associates, Ltd., Toronto (Ontario).

SHAFT SEAL DEVELOPMENT Final Report

I. J. Billington and T. E. Fitzsimmons Mar. 1966 26 p Revised

(AECL-2549; DSM-203-358, Rev.) AECL: $1.00

A coolant pump shaft seal development program is summarized; particular reference is made to the final endurance test series on hydrostatic, self-energized, finite clearance, seals. Results of 28,000 hours of testing, including 10,000 hours operation in pH 10 water are discussed. The endurance test program resolved the selection of seal geometry and materials. Critical inspection of a seal after 5,000 hr of operation indicated very low wear rate and slight surface changes, but no trend toward increased leakage or increased power requirement. A self-energized seal was installed in a primary coolant pump of the NPD Reactor. Author (NSA)

N67-28463# California Univ., Berkeley. Lawrence Radiation Lab.

PROBLEMS IN THE PRODUCTION OF THIN FILMS

W. Reichelt [1966] 30 p refs Transl. into ENGLISH from Vakuum-Tech. (Berlin), v. 15, Jan. 1966 p 1–8

(UCRL-TRANS-10063)

The advances attained in sputtering as well as in coating by evaporation at ultrahigh vacuum together with conventional coating by evaporation in large production plants during the recent years are treated. The part on sputtering contains the production of ions by means of thermionic emission, the sputtering of insulators, and the influence of substrate bias. The second part discusses the relations between the residual gas impact rate and the lattice

defects incorporated in the film together with technological problems of coating in ultrahigh vacuum. The third part presents experimental work from large production plants, highly evacuated, also the influences of temperature, condensation-speed and surface condition of the substrate on the condensed layer. Electron-beam evaporation sources are described. The last section informs about the evaporation of alloys and compounds. Author (NSA)

N67-28602# Naval Air Engineering Center, Philadelphia, Pa. Aeronautical Materials Lab.
CORROSION RESISTANCE AND DURABILITY OF FASTENERS IN AIRCRAFT STRUCTURES Progress Report, Jul. 1965–Feb. 1967
Joseph Viglione 26 Jan. 1967 44 p refs
(NAEC-AML-2529; AD-651189) CFSTI: HC$3.00/MF$0.65

A corrosion and fatigue evaluation was made to determine whether the rounding of countersunk holes and/or fastener heads would improve the corrosion behavior at the fastener locations or affect the fatigue strength of 7075-T6 aluminum alloy joints assembled with cadmium plated steel countersunk head screws. Test assemblies were prepared with and without corrosion barrier materials, including a MIL-S-8802 polysulfide sealant, in the finishing system. Rounded configurations did not significantly improve corrosion behavior but did improve the fatigue strength of the specimens. The greatest improvement in fatigue properties occurred with a combination of rounded fastener heads and rounded countersunk holes. Of the various corrosion barrier materials tested, only the polysulfide sealant afforded good corrosion protection when used with a paint system overcoat. However, the use of the sealant more than negated the beneficial effect of the rounded configurations on fatigue strength. The use of the sealant lowered the fatigue strength of the control specimens with standard fastener heads and standard countersunk holes by approximately 6%. This loss is counterbalanced by the improvement in corrosion behavior afforded by the sealant to fastener areas. Author (TAB)

N67-28629# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
NEWS IN MACHINE LUBRICANTS, CHAPTER IV AND V
M. V. Korovchinskiy 16 Feb. 1967 141 p refs Transl. into ENGLISH from the book "Novoye O Smazke v Mashinakh" Moscow, Izd. Nauk, 1964 p 68–176
(FTD-MT-65-401; TT-67-61601; AD-650806) CFSTI: HC $3.00/MF$0.65

Limiting cases of a two-dimensional elasto-hydrodynamic problem for two cylinders with parallel generatrices are analyzed. The values are found for finite extension of a lubricating layer at which the oil flow deviates scarcely from a plane and the influence of compressibility of the lubricant and heat emission in the lubricating layer on its supporting power and pressure distribution in it is analyzed. The effect of a change is viscosity with the change in temperature on an adiabatic flow of an incompressible lubricant is examined. Experiments with small loads on cylinders are described. The above-mentioned problem is also analyzed for the case of local contact between generatrices and a method is given to solve a problem concerned with isothermal flow of a lubricant and relative slip of an elastic cylinder for small values of rigidity numbers. An extensive bibliography is included of the 1961 literature on theory and calculations of thrust bearings, and on lubricants. TAB

N67-28633# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ROLLER STABILITY USING NEW SYNTHETIC LUBRICANTS
D. A. Draygor, A. S. Venzhega et al 23 Dec. 1966 21 p Transl. into ENGLISH from the book "Stoykost' Balkov Chistovogo Kholodnogo Prokata" Moscow, Mashinostr., 1964 p 108–121
(FTD-HT-66-376; TT-67-61592; AD-650743) CFSTI: HC $3.00/MF$0.65

Use in the rolling process of a thin layer of lubricating-cooling liquid containing new synthetic surface-active substances reveals a greater effect on roller stability, the technological rolling process, and the properties of rolled metal. Best results for clutching resistance have been demonstrated by emulsions containing 2.5-5.% methylolamide. Sulfonate or oxyethylated amine can be used as emulgator. An increase in roller stability is gained by decreasing clutching. Author (TAB)

N67-28638# Naval Air Engineering Center, Philadelphia, Pa. Materials Application and Engineering Div.
LUBRICATION EFFECTS OF CHEMICAL COMPOUNDS CONTAINED IN SEA WATER
Neal D. Rebuck 21 Dec. 1966 8 p
(NAEC-AML-2555; AD-650094) CFSTI: HC$3.00/MF$0.65

The report covers laboratory research on the use of sea water as a possible lubricant for bearing components of ocean vehicles and equipment. Focus is on the improved lubricating effect generated by sulfur compounds in contact with molybdenum surfaces. Results show sea water to exhibit the properties of a lubricating fluid for steel vs. molybdenum and bronze vs. molybdenum bearing combinations. Author (TAB)

N67-28680*# AiResearch Mfg. Co., Phoenix, Ariz.
INVESTIGATIONS OF GAS BEARING COMPRESSIBILITY NUMBER AND PIVOT FLEXURE IN TILTING PAD BEARINGS Final Report
31 Mar. 1967 158 p
(Contract NAS3-7633)
(NASA-CR-54939; APS-5223-R) CSCL 13I

Analytical and experimental investigations were conducted on a vertically oriented rotor supported on resiliently mounted tilting pad gas bearings to determine which bearing pad parameters govern the threshold of resonant whirl. Results show that for the particular configuration tested, there exists a critical value of pad eccentricity ratio for a given pad compressibility number. The above criteria are then theoretically applied to the analysis of an existing gas bearing turbocompressor in an effort to determine whether or not the turbocompressor rotor-bearing system will be stable at off-design conditions. Elastically pivoted partial-arc gas bearings were also tested. Under almost ideal isothermal conditions the tests demonstrated that this concept is a workable system affording rotor dynamic stability over a wide range of bearing pad loads. Author

N67-28758*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ADHESIVE BONDING OF STAINLESS STEELS
R. E. Keith, M. D. Randall, and D. C. Martin 16 Feb. 1967 64 p refs Prepared by Battelle Memorial Inst.
(Contract DA-01-021-AMC-11651(Z))
(NASA-TM-X-53574) CFSTI: HC$3.00/MF$0.65 CSCL 13H

This report covers the state of the art of adhesive bonding of stainless steels. Typical joint designs, surface preparation procedures, and environmental factors are described as they influence choice among the available adhesives and processing techniques. Both organic and inorganic adhesives are covered. Author

N67-28826*# Chrysler Corp., New Orleans, La. Space Div.
SATURN IB PROGRAM. TEST REPORT FOR FLEXIBLE HOSE, 1/4-INCH, 3000-psig AEROQUIP CORPORATION PART NUMBER 675003-4-0420, NASA DRAWING NUMBER 75M11337-4-0420
Robert Kolowith 20 Dec.
(Contract NAS8-4016)
(NASA-CR-84842, TR-RE-CCSD-FO-1005-3) CFSTI: HC $3.00/MF $0.65 CSCL 13K

This report presents the results of tests performed on three specimens of Flexible Hose 75M11337-4-0420. Performance of the flexible hoses was in accordance with specification requirements throughout the test program, except that leakage occurred at the fittings of all three specimens during most tests. This leakage did not increase significantly as testing progressed. Testing was continued on the premise that proof pressure testing with helium, and an inspection prior to installation, would preclude a leaking hose being installed in the system. Author

N67-28827*# Chrysler Corp., New Orleans, La. Space Div.
SATURN IB PROGRAM. BUTTER VALVE, 12-INCH, 3-psig Test Report
R. N. Marks 8 Mar. 1967 33 p
(Contract NAS8-4016, Pt.VII; CWO-271820)
(NASA-CR-84843; TR-RE-CCSD-FO-1073-3) CFSTI: HC $3.00/MF $0.65 CSCL 13K

This report presents the results of tests performed on one sample of Butterfly Valve. The following tests were performed: Receiving Inspection, Proof Pressure, Functional, Low Temperature, High Temperature, Flow, Cycle, Salt Fog. The results of the tests were satisfactory. The performance of the specimen was in accordance with specification requirements. Author

N67-28844# Ministry of Technology, London, (England). Technical Information and Library Services.
THE DESTRUCTION OF ELECTRIC EARTH CONDUCTORS BY WELDING CURRENTS. CAUSES AND PROTECTIVE MEASURES [DIE ZERSTOERUNG ELEKTRISCHER SCHUTZ-LEITER DURCH SCHWEISSSTROME. URSACHEN UND SCHUTZMASSNAHEN]
U. Sam Mar. 1967 13 p Transl. into ENGLISH from Schweisstech. (Switzerland), v. 6, 1966 p 251–257
(TIL/T-5698)

It is shown that if certain simple rules for the operating and arranging of welding equipment are not observed, damage can be caused to the earth conductors. Typical cases are examined in respect of type of work, and the disposition of the leads and working rules are derived from them. Author

N67-28906# Mechanical Technology, Inc., Latham, N. Y.
EFFECTS OF VISCOELASTIC LUBRICANT ON SQUEEZE FILM LUBRICATION BETWEEN IMPINGING SPHERES
Van C. Mow 24 Apr. 1967 32 p refs
(Contract 100014-66-C0037)
(MTI-67TR22; AD-651155) CFSTI: HC $3.00/MF $0.65

An asymptotic solution is obtained for squeeze flow between impinging spheres. The lubricant is assumed to be a four constant, nonlinear, viscoelastic liquid. The pressure peak in the lubricant is very sensitive to the values of viscoelastic constants. The results agree qualitatively with those observed experimentally. Author (TAB)

N67-28954# Automation Industries, Inc., Boulder, Colo. Research Div.
ADVANCEMENT OF ULTRASONIC TECHNIQUES USING RERADIATED SOUND ENERGIES FOR NONDESTRUCTIVE EVALUATION OF WELDMENTS Quarterly Progress Report, 1 Oct. 1966–15 Feb. 1967
B. T. Cross and W. M. Tooley 1 Mar. 1967 23 p
(Contract NObs-92530)
(TR-67-21; QPR-6; AD-650282) CFSTI: HC $3.00/MF $0.65

The single transmitter/single receiver Delta Configuration will be the most suitable configuration for use in a manual weld inspection probe. Test results similar to those presented in this report could be obtained on any of the structural weldments (butt weld) observed during a recent survey of shipyard welding practices. The ultrasonic instrumentation, the weld surface preparation, and the accessibility of the weldments, noted during the survey, would be compatible with Delta weld inspection using a manual probe. Feasibility of tee weld inspection with the Delta Technique has been established; however, the test results reported in this phase of testing are preliminary and should not suggest an optimum test for tee configuration weldments. The success of the initial tee weld tests indicated, however, that a set of general parameters for Delta weld inspection has been determined and that application of these parameters to inspection of various weld configuration need only minor change or addition. The knowledge gained from the study of transmitter lens designs, oscillating search unit motions, and multi-search unit Delta Configurations should provide the data input necessary to optimize the Delta Technique for inspecting various weld configurations and thicknesses. TAB

N67-28962# Automation Industries, Inc., Boulder, Colo. Research Div.
ADVANCEMENT OF ULTRASONIC TECHNIQUES USING RERADIATED SOUND ENERGIES FOR NONDESTRUCTIVE EVALUATION OF WELDMENTS Quarterly Progress Report, 1 Jul.–30 Sep. 1966
B. T. Cross and W. M. Tooley 5 Oct. 1966 15 p
(Contract NObs-92530)
(QPR-5; TR-66-42; AD-641354) CFSTI: HC $3.00/MF $0.65

The report describes the use of the Delta Configuration with a dual oscillating transmitter, a fixed divergent transmitter and a single oscillating divergent transmitter for inspecting steel butt welds. Schlieren studies of the transmitter configuration are included. The Delta Technique is a multi-search unit method of ultrasonic weld inspection. Incident energy is angled into the weld region from two transmitters positioned transverse to the weld length, one on each side of the weld. Flaw information is received with a third search unit positioned directly over the weld. Flaw information is not dependent on preferred flaw orientation, although the receiver must be directly over the defect. Author (TAB)

16 MASERS

Includes applications of masers and lasers. For basic research see: 26 Physics, Solid State.

N67-28362# *Royal Aircraft Establishment, Farnborough (England).*
ADJUSTABLE MIRROR MOUNT DESIGN USING KINEMATIC PRINCIPLES
D. A. Bateman Nov. 1966 29 p refs
(RAE-TR-66349) CFSTI: HC $3.00/MF $0.65

Various designs of mirror mounts are discussed in relation to their performance, construction, and choice of materials together with the principles of kinematic design. Examples are given of systems incorporating many of the optimum design features described which have a precision of several seconds of arc and which are suitable for general optical and laser work. Author (ESRO)

N67-28556# Air Force Cambridge Research Labs., Bedford, Mass. Solid State Sciences Lab.
LASER DAMAGE: A SELECTED LITERATURE SURVEY
Carl A. Pitha Feb. 1967 19 p refs /*ts* Spec. Rept. No. 60
(AFCRL-67-0137; AD-651210) CFSTI: HC $3.00/MF $0.65

This report is a review of selected references dealing with descriptions and possible causes of damage to laser component

elements functioning under high-power conditions, or to potential laser component materials exposed to high-power laser beams. Discussed are internal and surface damage, conditions prevailing in materials under lasing conditions, and the mechanisms proposed to account for the accumulation of sufficient energy for damage to take place; that is, self-focusing, stimulated Brillouin scattering, multiphoton absorption, and microplasma generation. Fifty-seven papers, published in 1964 - 1966, are included in the references.
Author (TAB)

N67-28564# Ballistic Research Labs., Aberdeen Proving Ground, Md.
IGNITION OF SOLID COMBUSTIBLES BY A RUBY LASER
Joseph L. Robitaille Oct. 1966 29 p refs
(BRL-MR-1799; AD-649526) CFSTI: HC $3.00/MF $0.65

The ignition of solid combustibles with a 3 millisecond pulse ruby laser has been performed. The samples investigated are newspaper, alpha cellulose, kraft paper, cotton, clothing, grass and wood. The samples studied were categorized according to their reflectances and absorptances at a wavelength of 6943A. The threshold energy for sustained ignition is reported as joules per unit area delivered to the surface of the material. The results of these experiments show that sustained ignitions depend upon the area exposed to the laser beam, the reflectance of the surface in the case of newspaper samples, and the thickness of the material. Wood shingles and cloth were only damaged; carbon impregnated alpha cellulose thicker than 8 mils and newspaper samples thicker than 19 mils did not burn.
Author (TAB)

17 MATERIALS, METALLIC

Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

N67-27792# National Gas Turbine Establishment, Pyestock (England).
SOME EFFECTS OF TEMPERATURE AND FREQUENCY ON THE DEFORMATION AND FATIGUE RUPTURE BEHAVIOUR OF H46
G. P. Tilly Jan. 1966 49 p refs
(NGTE-R-278) CFSTI: HC $3.00/MF $0.65

An 11 per cent chromium martensitic type steel (H46) was subjected to push-pull and repeated-tension loading at 20°C to 750°C, and the resulting behavior was shown to be similar to that of previously conducted tests on Nimonic 90. The material was found to be least resistant to fatigue at room temperature and to creep at elevated temperatures, and the damaging effects of the compressive reversals in push-pull cycles decreased with increase in temperature. The rupture durations tended to be dependent on number of cycles at the low temperatures irrespective of the frequency, but were dependent on time at elevated temperatures. The stress/time rupture curves of both H46 and Nimonic 90 were analyzed by a technique previously developed for creep data. Strain accumulated during the fatigue tests according to laws similar to those of conventional creep. The influences of frequency and temperature on the cumulative strains were examined. The strain/time curves were compared with those of comparable static tests, and it appeared that for similar durations, the fatigue tests failed at lower strains.
Author

N67-27903# Westinghouse Electric Corp., Pittsburgh, Pa.
WELDING PROCESS WITH X-RAY CONTROL OF WELD QUALITY
Heinz Stehle, Werner Kaden, and Alfred Schaal [1966] 5 p Transl. into ENGLISH from German patent PLA-66/1342 (WAPD-TRANS-46) CFSTI: HC $3.00/MF $0.65

A welding process is described whereby X-ray control of weld quality is carried out, preferably by a conventional reflection method, simultaneously with the production of the welded seam on a turning workpiece. This method is particularly useful for circular seams in the end caps of nuclear reactor fuel rod jackets.
NSA

N67-27904# Westinghouse Electric Corp., Pittsburgh, Pa. Atomic Power Div.
FRACTURE MECHANICS EVALUATION OF REACTOR VESSEL STEELS Technical Progress Report, Period Ending, Sep. 30, 1966
Oct. 1966 21 p
(Contract AT(30-1)-3677)
(WCAP-3677-1; EURAEC-1720) CFSTI: HC $3.00/MF $0.65

Experimental tests to be made on a group of reactor vessel steels to investigate the fracture mechanics technique to these materials in both the unirradiated and irradiated conditions are described. Materials to be investigated will include base metal, weld, and heat affected zone samples from two different heats of a Ni modified, Mn–Mo steel and a European forging grade material.
NSA

N67-27920# Institut de Recherches de la Siderurgie, Saint-Germain-en-Laye (France).
STUDY OF PARENT METAL FOR USE IN RESEARCH INTO BRITTLE FRACTURE OF LARGE WELDMENTS Quarterly Report, 1 Jul.–30 Sep. 1965
Oct. 1965 20 p
(EURAEC-1499; EUR-2657; QR-6) CFSTI: HC $3.00/MF $0.65

Studies were made on the anisothermal stress relieving and structural transformations in Super ELSO steel and Jominy quenchability and mechanical properties of AMMO steel. The optimum stress relieving treatment for the different tests performed was at a maximum temperature of 600°C, with a time at temperature of more than 2 hr. The influence of the heating temperature on transformations during rapid thermal cycling was noted. Tests on the Jominy quenchability and mechanical properties of AMMO steel showed that they differ appreciably between the core and the surface (7 kg/mm^2 difference in the yield strength, for instance). Chemical analysis and differential dilatometry, on the other hand, gave similar results for both the core and surface.
NSA

N67-27948# Army Missile Command, Huntsville, Ala.
DUCTILITY OF REFRACTORY METALS THROUGH THERMAL TECHNIQUES
Julian E. Bynum *In* Army Dept. Proc. of the 1966 Army Sci. Conf., Vol. I 26 Aug. 1966 p 103–117 refs (See N67-27941 15-34)
(AD-634665)

Effects of thermal environments on room temperature ductility and tensile strength of molybdenum wires were investigated, after attempts to measure room temperature ductility of tungsten wires proved futile. Excellent ductility results from rapid heating of Mo to elevated temperatures in both high and low vacuums; and the reversibility phenomenon, that is ductility lost by slow reheating to the same elevated temperature, occurs only in the low vacuum. Reversibility is, therefore, attributed to one or more of the atmospheric gases or carbon from backstreaming of the vacuum pump oil. The experimental data suggest that rapid heating increases

the tolerance of Mo for interstitials, and that this increased tolerance may be a function of the distribution and concentration of interstitial solutes. It has previously been shown that the distribution of solutes has a significant effect on both ductility and transition temperature. M.W.R.

N67-27951# Army Materials Research Agency, Watertown, Mass.
ANISOTROPY AND ITS RELATIONSHIP TO DEEP DRAWING OF A 5% Cr TOOL STEEL (H-11) FOR THE HAWK MISSILE
Robert M. Colton and James D. Colgate *In* Army Dept. Proc. of the 1966 Army Sci. Conf., Vol. I 26 Aug. 1966 p 165–179 refs (See N67-27941 15-34)
(AD-634669)

Poor drawability of 5% Cr tool H-11 sheet steel is attributed to excessively high values of planar anisotropy caused by low hot rolling finishing temperatures and incomplete spheroidization. Acceptable drawability was exhibited by material with minimum elongation values of 25%, maximum yield strength values of 55,000 psi, and maximum planar anisotropy of (.25). Even with drawing variables at optimum levels, the severity of hydroforming the accumulator dome (as in the Hawk missile oil accumulator dome) caused a failure rate during drawing of between 2 and 9%. Anisotropy, microstructural, and X-ray diffraction measurements are reported. The relationship between anisotropy and drawing is discussed, as are planar anisotropy, drawing yield strength, ductility, and brittle ductile transition temperatures. M.W.R.

N67-27965# Watervliet Arsenal, N. Y.
STRESS-AGING AND ITS EFFECTS ON TENSILE PROPERTIES OF SOME STAINLESS AND ULTRA-HIGH-STRENGTH STEELS
Richards H. Harrington *In* Army Dept. Proc. of the 1966 Army Sci. Conf., Vol. I 26 Aug. 1966 p 421–435 refs (See N67-27941 15-34)
(AD-634667)

Stress-aging results are presented for three stainless steels and four ultrahigh strength steels. Based on design stress levels, elongation, and reduction of area, stress aging raises the stainless steels into the strength category of the ultrahigh strength metals. Stress aging effects considerable improvement in strength of the ultrahighs without concurrent losses in elongation, reduction of area, or relative toughness. Stress aging reactions are controlled by the magnitude of applied elastic stress, the temperature, and the time at temperature. The higher the applied stress, the higher the temperature, and the longer the time; the greater are the effects on tensile properties. After maximum desirable values are obtained, tensile properties deteriorate because of over-aging, grain boundary precipitation, embrittlement, re-solution, and/or recrystallization. Stress aging effects are considered between 80 and 90% complete in about 15 to 30 minutes at most effective temperatures. M.W.R.

N67-28006*# Boeing Scientific Research Labs., Seattle, Wash. Solid State Physics Lab.
STRESS CORROSION CRACKING OF TITANIUM ALLOYS HEAT TREATMENT EFFECTS, SCC VELOCITY IN VARIOUS SOLVENTS AND ELECTROCHEMICAL KINETICS WITH Ti:8-1-1 ALLOY Quarterly Progress Report, 1 Oct.–31 Dec. 1966
T. R. Beck Dec. 1966 48 p ref
(Contract NAS7-489)
(NASA-CR-84653; QPR-2) CFSTI: HC $3.00/MF $0.65 CSCL 11F

Stress corrosion cracking of titanium:8%Al–1%Mo–1%V alloy was studied. Pre-cracked specimens were introduced to the studies resulting in lower failure loads and providing a wider range of stress for study. Heat treatment effects and various solvent environments were investigated. Electrochemical kinetic measurements were made to obtain more quantitative numbers for the parameters used in the electrochemical models describing velocity control. One of the interesting findings is that SCC of Ti:8-1-1 occurred in pure water and methanol, but could be suppressed by addition of small amounts of nitrate or sulfate—on the order of 10–100 ppm. The Ti:8-1-1 was also susceptible to SCC in chlorinated solvents such as carbon tetrachloride, methylene chloride and trichlorethylene. Heat treatment has a very marked effect on fracture load and crack velocity. Evidence from the kinetic studies indicates that the hydride mechanism does not play a role in SCC of Ti:8-1-1 under the conditions used. Author

N67-28040 Royal Aircraft Establishment, Farnborough (England).
A REVIEW OF CURRENT INFORMATION ON Ti–8Al–1Mo–1V ALLOY SHEET
A. R. G. Brown Sep. 1964 29 p refs
(RAE-TR-64003)

A review of published data on the Ti–8Al–1Mo–1V alloy is given; data are quoted for tensile strengths, compressive strengths, tensile and compressive moduli, fatigue strength, stability under load, weldability, static residual strength and susceptibility to hot salt stress corrosion. Author

N67-28099# Naval Research Lab., Washington, D. C. Organic and Biological Chemistry Branch.
PROTECTIVE COATINGS FOR MAGNESIUM ALLOYS. PART 3. COORDINATION CHEMISTRY OF THE MAGNESIUM ION
D. L. Venezsky 2 Mar. 1967 31 p refs
(NRL-R-6510; AD-649323) CFSTI: HC $3.00/MF $0.65

The coordination chemistry of magnesium ions was studied with respect to neutral, but polar, unidentate ligands in the presence of various donor anions. Complexes of the type (MgLn)A2 were prepared. Chemical analysis, infrared spectral data, and electrical conductivity were used to assign the structure of the isolated products. The ligands L were dimethyl sulfoxide, pyridine N-oxide, triphenylphosphine oxide, and triphenylarsine oxide. The value of n depended on the size of the ligand and the nature of the anion A, which was varied from a weak donor (perchlorate ion) to strong donors (acetate or methacrylate ions). The maximum value of n was six when the ligands were dimethyl sulfoxide or pyridine N-oxide and the anions were perchlorate ions. The bulkier ligands, triphenylphosphine oxide and triphenylarsine oxide, were sterically restricted to only four ligands per magnesium ion even when the anions were perchlorate ions. The methacrylate ions successfully competed for first coordination-sphere positions about the magnesium ions; the weak-donor ligands, dimethyl sulfoxide and pyridine N-oxide, were readily displaced. The infrared spectral data indicates that the methacrylate anions act as bidentate ligands; however, the stoichiometry of some of the complexes can only be explained if the acetate and methacrylate anions function as unidentate ligands. Author (TAB)

N67-28100# Harvard Univ., Cambridge, Mass. Engineering and Applied Physics Div.
MEASUREMENTS OF THE DRAGGING SMALL OXIDE PARTICLES OF MIGRATING GRAIN BOUNDARIES IN COPPER
M. F. Ashby and R. M. A. Centamore Jan. 1967 47 p refs
(Contract Nonr-1866(27))
(TR-518; AD-649516) CFSTI: HC $3.00/MF $0.65

Grain boundaries, introduced into a copper single crystal by indenting and annealing the crystal, are shown to drag certain small (4000A diameter) oxide particles with them when they migrate. GeO2 and B2O3 particles are dragged rapidly (with speeds up to 1 micron per minute) at temperatures between 650 and

1050C; SiO2 particles are rather less mobile, and Al2O3 particles are, within the accuracy of the experiments, immobile. Measurements of the distance through which particles are dragged as a function of time and temperature yield activation energies for the dragging process, and mobilities for each sort of particle. Above 1000C, the mobile particles all show about the same activation energy, and mobility; all aspects of their movement suggest that their mobility is controlled by diffusion of matrix atoms in the interface between particle and matrix. At lower temperatures the mobilities and activation energies become strongly dependent on the composition of the particles, and cannot readily be explained. Author (TAB)

N67-28175 Joint Publications Research Service, Washington, D. C.

BEHAVIOR OF STAINLESS STEELS IN SODIUM IN THE 600–900° TEMPERATURE RANGE

N. P. Agapova, A. G. Ioltukhovskiy, and V. V. Romaneyev *In its* Sodium-Cooled Nucl. Reactors 24 Feb. 1967 p 18–30 (See N67-28173 15-22)
(SM-85/51)

The reaction of steel with the flow of molten sodium was studied on test stands with forced coolant circulation. The schematic of the typical stand is given. The main working parameters of the high-temperature stands are listed. The evaluation of the stability of materials was gauged from change in structure, weight, and mechanical properties. The behavior in sodium of the principal components of steel, iron, nickel, and chromium was studied in advance. The following were selected as the materials investigated: armco-iron, electrolytic nickel, and cast deformed chromium. Tests in sodium showed that the behavior of all these materials is determined to a considerable extent by the test conditions, and nickel reacts particularly vigorously to changes in these conditions. Thus, its stability is markedly reduced with increase in temperature and flow rate of sodium. Results indicate that the ratio between iron, nickel, and chromium in steels and alloys govern their behavior in the sodium coolant to a considerable extent. Author

N67-28214# Brussels Univ. (Belgium).

A SURVEY OF SOME METAL OXIDATION PROBLEMS Quarterly Progress Report No. 13, 1 Jan.–31 Mar. 1966

[1966] 12 p
(Contract EURATOM-079-64-10-TEEB)
(EURAEC-1619; EUR-2832) CFSTI: HC $3.00/MF $0.65

Developments in studies on the controlled oxidation of Al and iodation of Cu are reported. The existence of a period of incubation followed by a period of nucleus growth and finally by a period of continuous layer growth was found in the oxidation of Al. The effects of crystalline force, reactor temperature, and pressure are discussed. The most favorable conditions found for the iodation of copper were 340°C and a partial pressure of 0.23 mm Hg. The existence of a continuous layer preceding nucleation was also found. The possible effects of layer thickness are discussed. NSA

N67-28215# Chantiers de l'Atlantique Saint-Nazaire (France).

AUSTENITIZATION OF WELMONIX STEEL

15 Jun. 1966 8 p *Its* Study No. 1018
(Contract EURATOM-054-61-12-RDF)
(EURAEC-1711; EUR-2893) CFSTI: HC $3.00/MF $0.65

Results of a study of re-austenization of Wel-Monix steel after heating to 1250°C are shown in photomicrographs. NSA

N67-28216# Saint Marys Coll., Winona, Minn.

EXPERIMENTAL STUDY OF THE SURFACE STRUCTURE AND ELECTRONIC PROPERTIES OF SINGLE CRYSTAL MOLYBDENUM AND TUNGSTEN RIBBONS Progress Report, 1 Nov. 1965–1 Aug. 1966

Donald R. Morgan and William E. Blass 1 Aug. 1966 19 p refs
(Contract AT(11-1)-1417)
(COO-1417-2) CFSTI: HC $3.00/MF $0.65

Improved techniques for preparation of metallographic specimens indicate that Mo single crystals can be produced which show highly ordered surfaces after heating to 2000°K at pressures below 10^{-8} torr, as well as crystals with varying degrees of surface disorder. Low energy electron diffraction patterns for a Mo (100) surface were obtained. With improved equipment, measurements will be made of thermionic emissions of Mo and W single crystals. NSA

N67-28217# Denver Research Inst., Colo.

STUDIES OF THE EFFECT OF INTERSTITIAL ADDITION ON THE PHASE EQUILIBRIA OF THE NIOBIUM-RICH REGION OF THE NIOBIUM–TUNGSTEN–HAFNIUM AND NIOBIUM–TUNGSTEN–ZIRCONIUM ALLOY SYSTEMS

Albert S. Yamamoto Dec. 1966 11 p
(Contract AT(11-1)-1092)
(DRI-2369; QPR-9) CFSTI: HC $3.00/MF $0.65

Data on phases and microhardness of a number of Hf–Nb–W–Zr alloys containing interstitial C or O_2, are reported. NSA

N67-28219# Johns-Manville Research Center, Manville, N. J.

DEVELOP 1800F–400F FIBROUS-TYPE INSULATION FOR RADIOISOTOPE POWER SYSTEMS Third Quarterly Progress Report, 3 Oct.–30 Dec. 1966

J. O. Collins 3 Jan. 1967 61 p
(Contract AT(30-1)-3633)
(ALO-3633-3) CFSTI: HC $3.00/MF $0.65

The physical properties (excluding thermal conductivity) of Microtherm were investigated. Formulations 1999 and 2002, developed for lead telluride service, have been placed under prolonged compatibility tests, as have the fibrous candidates for the higher temperature silicon–germanium service. A complete evaluation of the stress–strain characteristic of Formulation 2002 and the effect of numerous variables on this characteristic has been completed. Developmental efforts are concentrated upon a more thermally stable formulation for application in silicon–germanium systems. Author (NSA)

N67-28227*# Holman (John F.) and Co., Inc., Washington, D. C.

INVESTIGATING THE POSSIBILITY OF OBTAINING STELLITE POWDER [ISSLEDOVANIYE VOZMOZHNOSTI POLUCHENIYA POROSHKA STELLITA]

V. G. Teplenko, Z. V. Solov'yeva, and G. T. Makshantseva Washington, NASA, May 1967 6 p refs Transl. into ENGLISH from Sb. Tr. Tsentr. Nauchn.-Issled. Chernoi Met. (Moscow), no. 43, 1965 p 115–118
(Contract NASw-1495)
(NASA-TT-F-10946) CFSTI: HC $3.00/MF $0.65 CSCL 11F

The basic technological parameters for obtaining stellite powder by the method of combined reduction have been established. To improve the workability of the sintered mass a "separator"–sodium chloride in the amount of 3–5 percent of the alloy mass is introduced into the charge. The stellite powder has good pressing properties. Briquettes made of it by the method of hot pressing have a relative density which is close to the theoretical value 91–93 percent; their hardness is 43–44 HRC, i.e., it is of the same order as that of cast stellite with the same composition. Author

N67-28237* Holman (John F.) and Co., Inc., Washington, D. C.
THE INTERDIFFUSION OF THE COMPONENTS AND PHASE DIAGRAM OF THE SYSTEM Ti–W [VZAIMNAYA DIFFUSIYA KOMPONENTOV I DIAGRAMMA SOSTOYANIYA SISTEMY Ti–W]
A. Ya. Shinyayev, L. F. Sokiryanskiy, S. A. Ditsmon, and T. A. Kupriyanov Washington, NASA, Jun. 1967 8 p refs Transl. into ENGLISH from the book "Novyye Issledovaniya Titanovykh Splavov" Moscow, Izd. Nauka, 1965 p 43–47
(Contract NASw-1495)
(NASA-TT-F-11010) CSCL 11F

Determination of the mutual-diffusion characteristics of titanium–tungsten mixtures in the temperature range from 1000 to 1600°. A sharp discontinuity of the concentration curve, attesting to the presence of a two-phase region. It is believed that this two-phase region exists up to the melting point of the alloys. It is suggested that the difference in the interaction between titanium and tungsten, on the one hand, and the interaction between titanium and molybdenum, on the other hand, may be due to the great difference between the binding energies of tungsten and molybdenum. Author

N67-28238*# Holman (John F.) and Co., Inc., Washington, D. C.
PHASE EQUILIBRIUM IN THE SYSTEM Ti–V–C AT 1450, 1600 AND 1800° [FAZOVYYE RAVNOVESIYA V SISTEME Ti–V–C PRI 1450, 1600 I 1800°]
L. A. Tret'yachenko and V. N. Yeremenko Washington, NASA, Jun. 1967 10 p refs Transl. into ENGLISH from the book "Novyye Issledovaniya Titanovykh Splavov" Moscow, Izd. Nauka, 1965 p 75–81
(Contract NASw-1495)
(NASA-TT-F-11012) CSCL 11F

Calculation of the phase diagram of the system Ti–V–C on the basis of a study of the phase equilibria in this system. Certain elements of the phase diagram of the system V–C are redetermined with improved accuracy. Isothermal cross sections of the phase diagram of the ternary system Ti–V–C at 1450, 1600 and 1800° are plotted according to the results of metallographic and X-ray diffraction analyses, the results of microhardness measurements, and a determination of the incipent-melting temperatures of alloys prepared by arc melting and heat treated at these temperatures. Author

N67-28245# Naval Research Lab., Washington, D. C.
ANALYSIS OF STRESS-CORROSION CRACKING OF Ti-6Al-4V FUEL TANK MATERIAL IN METHYL ALCOHOL
D. A. Meyn, E. P. Dahlberg, and C. D. Beachem Jan. 1967 24 p refs
(NRL-MR-1744; AD-649187) CFSTI: HC $3.00/MF $0.65

Material from a high yield strength 6Al-4V titanium alloy space vehicle fuel tank was found to be susceptible to stress-corrosion cracking in methyl alcohol by an unidentified cleavage mechanism. Cracks propagated in contact with methanol at plane strain stress intensities as low as 15 ksi in. The same material was found to be somewhat susceptible to cracking in distilled water, by the same mechanism, with a crack propagating at a plane strain stress intensity of about 30 ksi in. Author (TAB)

N67-28282*# National Aeronautics and Space Administration, Washington, D. C.
NEW DEVELOPMENTS IN POWDER METALLURGY [NOVYYE PUTI RAZVITIYA POROSHKOVOY METALLURGII]
B. A. Borok Washington, NASA, May 1967 19 p refs Transl. into ENGLISH from Poroshkovaya Met., SB. Trudov Tsentr. Nauchno-Issled. (Moscow), no. 43, 1965 p 5–20
(Contract NASw-1495)
(NASA-TT-F-10945) CSCL 13H

The methods of hydrostatic pressing and induction sintering make it possible to produce large sintered billets from powders of pure metals and alloys including those obtained by combined reduction. The alloys produced by the cermet method are characterized by the homogeneity of the chemical composition and micro-structure. The possibility of hardening metals and alloys by dispersed inclusions of oxides, nitrides, etc. makes it possible to develop new materials for operation at high temperatures and loads. The method of obtaining ribbon and thin sheets by the direct rolling of powders provides for high effective output. The homogeneity of the composition and the fine-grain, uniform structure provide for the deformability of sintered billets produced from high alloyed multiple component alloys. Author

N67-28283* International Information, Inc., Philadelphia, Pa.
THE INITIAL FORMATION AND GROWTH OF INTERMETALLIC PHASES IN THE Cu–Zn SYSTEM [TWORZENIE I WZROST FAZ MIEDZYMETALICZNYCH W UKLADZIE Cu–Zn]
H. Matyja and St. Gabricki Washington, NASA, Jun. 1967 9 p refs Transl. into ENGLISH from the Polish
(Contract NASw-1499)
(NASA-TT-F-10942) CSCL 11F

Observations are presented with respect to the kinetics of the growth of individual beta, gamma, and epsilon intermetallic phases in the Cu–Zn system. Diffusion layer thickness is shown to be a parabolic function of time. A calculation is made of the activation energy for the growth of the individual intermetallic phases. Author

N67-28295*# Farnham (Frank C.) Co., Philadelphia, Pa.
THE EFFECT OF SMALL ADDITIONS OF REFRACTORY ON THE STRUCTURE AND PROPERTIES OF SHEETS OF AN ALUMINUM ALLOY CONTAINING 5% Zn AND 2% Mg [VLIYANIYE MALYKH DOBAVOK TUGOPLAVKIKH ELEMENTOV NA STRUKTURY I SVOYSTVA LISTOV IZ ALYUMINIYEVOGO SPLAVA, SODERZHASCHEGO 5% Zn I 2% Mg]
K. S. Kirpichnikov, V. I. Kulakov, and M. T. Shchekina Washington, NASA, Jun. 1967 10 p Transl. into ENGLISH from Strukit. Svoystva Aviats. Staley Splavov (Moscow), 1966 p 147–156
(Contract NASw-1497)
(NASA-TT-F-11015) CSCL 11F

A study of the effect of small additions of Zr, Ti, Be, Cr, and Mn, separately and in combination, on the structure and properties of the alloy Al–Zn–Mg in various states. The optimal additions, which ensure both good mechanical properties and high corrosion resistance, are found to be Zr and Zr+Ti. It is observed that the addition of Zr greatly increases the recrystallization threshold of the alloy Al–Zn–Mg, while the addition of Ti, Be, or binary additives, including Zr+Ti has practically no effect on this threshold. Author

N67-28297*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
FRACTURE TOUGHNESS OF WIDE 2014-T6 ALUMINUM SHEET AT −320°F
Thomas W. Orange Washington, NASA, Jun. 1967 36 p refs (NASA-TN-D-4017) CFSTI: $3.00/MF $0.65 CSCL 20K

An experimental program was conducted to investigate the effect of test specimen size on the plane-stress fracture-toughness parameter K_c and to provide a broad base of data for comparing the effectiveness of several methods of fracture analysis. Fracture specimens 3, 6, and 12 inches (7.5, 15, and 30 cm) wide of 2014-T6 aluminum alloy 0.060 inch (1.5 mm) thick having initial notches from 1/8 inch (3.2 mm) to one-third the specimen width were tested at −320° F (77° K). Critical crack length was measured with the NASA continuity gage. Conventional smooth and notched

tensile properties were measured at 70°, −320°, and −423°F (293°, 77°, and 20°K). For the transverse direction, a 3-inch-wide (7.5 cm) specimen was adequate to determine K_c; for the tougher longitudinal direction, a wider specimen was required. For the 3-inch-wide specimens, maintaining the net fracture stress below 80 percent of the yield stress did not ensure a valid test. Essentially constant values of K_c were obtained when net fracture stresses were below about 75 percent of yield. Author

N67-28298*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
STATUS OF POROUS IONIZERS FOR CONTACT IONIZATION OF CESIUM
Larry C. Headley Washington, NASA, Jun. 1967 28 p refs
(NASA-TN-D-3997) CFSTI: HC $3.00/MF $0.65 CSCL 20I

Much of the recent information obtained from tests of materials under consideration for use as porous ionizers in cesium-ion sources and cesium-ion thrustors is summarized herein. The information presented for the various materials includes sintering characteristics, pore densities and diameters, work functions, emittances, methods of manufacture, and ionization performance. The ionization performance is described by including graphs of ion-current density against critical temperature, neutral fraction against critical temperature, and ion-current density against neutral fraction. Author

N67-28311# General Dynamics Corp., San Diego, Calif. John Jay Hopkins Lab. for Pure and Applied Science.
A RESEARCH PROGRAM ON THE EFFECT OF SUBSTRUCTURE ON THE IRRADIATION STABILITY OF ASTM A302 GRADE B STEEL Quarterly Progress Report
T. A. Trozera and P. W. Flynn 18 Oct. 1966 13 p
(Contract AT(04-3)-167)
(GA-7483; EURAEC-1741; QPR-6) CFSTI: HC $3.00/MF $0.65

The first irradiation capsule was inserted in the Low Intensity Test Reactor (LITR) at Oak Ridge National Laboratory and the second capsule is ready for insertion. Samples of cold-worked and heat-treated A302-B steel and warm-worked A302-B steel were thinned for electron-microscopic examination. Author

N67-28321# Battelle Memorial Inst., Columbus, Ohio.
DEVELOPMENT OF FILAMENT-REINFORCED METALS Final Report, 24 Jun. 1965–24 Dec. 1966
Dale E. Niesz, Charles W. Kistler, Jr., and James N. Fleck 16 Jan. 1967 95 p refs
(Contract NOw-65-0615-c)
(AD-649509) CFSTI: HC $3.00/MF $0.65

An investigation was conducted to develop filament-reinforced metals for use at elevated temperatures. The use of carbon filaments to reinforce nickel, cobalt, aluminum and platinum, and the use of silicon carbide filaments to reinforce aluminum and nickel were considered. Uniform microstructures were obtained by fabricating composites from metal-coated filaments where the coating becomes the matrix of the composite. Of the coating techniques investigated, electroless deposition was found to be the most suitable for obtaining uniform coatings on the individual filaments of Thornel yarn. Although the phosphorus content of nickel obtained from conventional electroless-nickel plating baths made this material useless as a matrix, conventional electroless-cobalt produced an attractive matrix material. Phosphorus-free nickel and platinum coatings of relatively high purity were obtained by electroless deposition using hydrazine as a reducing agent. These materials are attractive matrices. Cobalt-Thornel composites were fabricated by swaging and hot isostatically compacting cobalt-coated Thornel filaments. The microstructural stability of these composites at 1800 F was excellent, but their oxidation behavior was erratic. The maximum tensile strength attained in room temperature measurements was approximately 50 percent of the theoretical strength, as calculated using a continuous-filament model, and was attained for a filament content of approximately 50 volume percent. The tensile strengths at 1400 and 1800 F were also low. These low strengths were attributed to the low aspect ratio of the filaments due to breakup during fabrication. Author (TAB)

N67-28344# Oklahoma Univ. Research Inst., Norman.
SORPTION KINETICS AND MECHANICAL PROPERTIES OF DILUTE COLUMBIUM–HYDROGEN SOLUTIONS
Thomas Glenn Oakwood and Raymond D. Daniels Feb. 1967 124 p refs
(Contract AT(40-1)-2570)
(ORO-2570-10) CFSTI: HC $3.00/MF $0.65

The sorption kinetics and mechanical properties of dilute Nb–H solutions were investigated. The sorption kinetics, measured by a thermal equilibrium technique, was found to be sensitive to surface condition and insensitive to grain size. The sorption rate was adequately described by a diffusion controlled reaction in the temperature range 600° to 750°C provided that the metal surface was abraded to remove effects of chemical etching. Below 600°C a surface step reaction apparently controls the sorption process, rather than bulk diffusion. H_2 was found to have little effect on the strength of Nb in the temperature range 77° to 300°K. The ductility of hydrogenated Nb, however, was found to be sensitive to H_2 concentration, temperature, and microstructure. At 300°K, an abrupt loss in ductility was observed at a critical H_2 concentration. A similar result was found at a lower H_2 concentration at 191°K, with the ductility loss being greater at the lower temperature. At 77°K, however, a gradual loss in ductility with increasing H_2 content was observed. Hydrogenated Nb was thus observed to undergo a ductile–brittle–ductile transition as the temperature was lowered from 300° to 77°K. Crack formation appears to be due to a hydride precipitation in localized regions of high hydrogen concentration. H_2 diffusion in the microcracks from the surrounding regions is evidently responsible for crack propagation. H_2 apparently either adsorbs on the internal surfaces of a microcrack thereby lowering its surface energy, or diffuses to the tip of a crack resulting in a lower Nb atom bond strength. NSA

N67-28370*# General Electric Co., Cincinnati, Ohio. Nuclear Technology Dept.
MEASUREMENT OF THE PERMEABILITY OF TUNGSTEN TO NITROGEN Final Report
P. K. Conn, E. C. Duderstadt, and R. E. Fryxell Jun. 1967 21 p refs
(Contract NAS3-7967)
(NASA-CR-72238; GE-NMP-67-522) CFSTI: HC $3.00/MF $0.65 CSCL 11F

Permeation rates of nitrogen through arc-cast tungsten were measured in the temperature range 1800° to 2600°C with nitrogen pressure differentials of 1 and 0.1 atmospheres. Rates were proportional to the difference between the square roots of the nitrogen pressure on each side of the membranes and inversely proportional to membrane thickness, indicating that atomic nitrogen was the diffusing species and that diffusion was the rate limiting step of the process. The activation energy for permeation was found to be 70.0±0.8 kcal/mole of permeating species. Author

N67-28487# Florida Univ., Gainesville. Dept. of Metallurgical and Materials Engineering.
INTERNAL FRICTION STUDY OF THE MOVEMENT OF TWIN BOUNDARIES Annual Report, 1966
Robert E. Reed-Hill 15 Feb. 1967 31 p refs
(Contract AT(40-1)-3262)
(ORO-3262-3) CFSTI: HC $3.00/MF $0.65

Developments are reported for studies on tensile tests in liquid He, and the role of twinning in the plastic deformation of Zr. A method for the investigation of polycrystalline deformation is described. Data on tensile properties of Zr measured in liquid He are tabulated. The development of a theory of strain relaxation at constant stress or stress relaxation at constant strain is also reported. NSA

N67-28510# Frankford Arsenal, Philadelphia, Pa. Pitman-Dunn Labs.

HEAT TREATMENT AND MECHANICAL PROPERTIES OF A URANIUM-2% Mo-2% Zr-2% Nb-0.5% Ti ALLOY

Michael Myers and Ralph E. Edelman Jul. 1966 10 p refs
(M67-1-1; AD-637777) CFSTI: HC $3.00/MF $0.65

A study was made of a uranium-2% Mo-2% Zr-2% Nb-0.5%Ti alloy in the rolled and forged conditions. It was found that, in the asworked condition, this alloy possessed little or no ductility. However, in the solution-treated and aged condition, it did possess a measurable amount (1 to 3 percent elongation) of ductility. Author (TAB)

N67-28518# Argonne National Lab., Ill.

THE EFFECT OF THE PRESSURE–TEMPERATURE HISTORY UPON INCIPIENT-BOILING SUPERHEATS IN LIQUID METALS

Robert E. Holtz Jun. 1966 40 p refs
(Contract W-31-109-ENG-38)
(ANL-7184) CFSTI: HC $3.00/MF $0.65

The degrees of liquid superheat required to initiate boiling in the alkali metals are found by examining the pressure–temperature history of the system and by using the bubble-equilibrium equation. The calculated incipient-boiling superheats for sodium and potassium are shown to be in agreement with data presented in the literature. Author

N67-28554# Centro Atomico Bariloche (Argentina).

PLASTIC DEFORMATION IN ORDERED SOLID SOLUTIONS AND ITS EFFECTS ON PHYSICAL PROPERTIES Final Report

Aldo E. Vidoz 1966 16 p refs
(Grant DA-ARO-49-092-65-G83)
(Rept.-3; AD-651192) CFSTI: HC $3.00/MF $0.65

Deformation tests were made of Ni3 Fe and Cu3 Au. Disordered state single crystals show 3 stages deformation as in pure metals. But 1st stage due propagation Luders bands. Stage II linear hardening with slop G/400, G = shear modulus. In ordered state linear work hardening depends on domain size, test temp., crystallographic orientation. Tensile axis rotation agrees with calc. assuming single glide. Deformation tensile axis overshoots symmetry line (100)(111), shows strong latent hardening secondary systems. Strain ageing depends critically stage of deformation. Secondary slip important in controlling plastic deformation ordered Solid Solutions. Formation antiphase boundary tubes explains exptl. results if original model modified with geometrical relationship between primary and conjugate applied stresses and consideration of latent hardening effect. An investigation was made of the dependence alpha on domain size Cu3 Au. Alpha reaches saturation value after no further increase in degree of order. Longer annealing modifies domain size but alpha constant. Activation energy 25 Kcal /mole. continues. An investigation was made of activation enthalpies and volumes for creep in Ni3 Fe in temp. range 40 - 150C, ordered and disord cond. Above 150C, ageing effect interferes, deformation becomes discontinuous. Kinetics of ageing faster in disordered state. Self diffusion of Ni creep controlling at high temp., max. at 72/25 Ni/Fe comp. Author (TAB)

N67-28555# Army Materials Research Agency, Watertown, Mass.

A REFINEMENT OF THE PARAMETERS OF ALPHA MANGANESE

Charles P. Gazzara, Raymond M. Middleton, R. J. Weiss, and E. O. Hall (Newcastle Univ.) Mar. 1967 15 p refs
(AMRA-TR-67-08; AD-651205) CFSTI: HC $3.00/MF $0.65

The atomic parameters of alpha manganese, first determined by Bradley and Thewlis (1927), have been refined from an R index of 0.093 to a final R of 0.029 for fifty reflections. This refinement was based on an analysis of the integrated intensities of X-ray diffracted powder peaks measured independently at two laboratories. The lattice constant of alpha manganese was determined from liquid helium temperature up to room temperature and a change in the thermal expansion coefficient was found in the vicinity of the Neel temperature (95 K) although no structural change was observed in this region. Author (TAB)

N67-28569# Pennsylvania Univ., Philadelphia. School of Metallurgical Engineering.

A STUDY OF THE EARLY STAGES OF PLASTIC DEFORMATION Final Report

Norman Brown 17 Mar. 1967 16 p refs
(Contract Nonr-551(20))
(AD-649168) CFSTI: HC $3.00/MF $0.65

This is a review of research on microplasticity from 1956 to 1965. Topics related to microplasticity were: (1) the effect of grain size (2) low temperature deformation of body centered cubic metals (3) deformation of single crystal and polycrystalline face centered cubic metals (4) strength of martensite, (5) sodium chloride and (6) dispersion strengthening. In general, the transition from elastic to plastic behavior was characterized by an elastic limit, a microplastic limit and an energy loss in the anelastic region. Important conclusions from the research were: (1) The amount of pre-yield microstrain varies as strongly as the cube of the grain size in some metals and is independent of grain size in others. (2) The elastic limit of body centered cubic metals has a very small dependence on temperature even down to 5 degrees K when compared to the microscopic yield point. (3) A small amount of plastic strain reduces the elastic limit of an annealed crystal. (4) In a dispersion strengthened system, the elastic limit is independent of the dispersion once the material is strained elastically. (5) The structure involving dispersed particles which are connected by grown in dislocations gives a strengthening which varies inversely as the square root of the spacing between particles. (6) The microplastic limit of as-quenched iron-carbon martensite at a plastic strain resistivity of about (10-6) is about one-half of the microscopic yield point.9 (7) After tempering iron-carbon martensite to about 280 degrees the microplastic limit and the microscopic yield points are about the same. TAB

N67-28600# Virginia Polytechnic Inst., Blacksburg. Dept. of Metals and Ceramic Engineering.

THE RELATIONSHIP OF NITROGEN CONTENT OF AUSTENITIC STAINLESS STEELS TO STRESS CORROSION Quarterly Report, 1 Oct.–31 Dec. 1966

Thomas B. Cox and John F. Eckel 31 Dec. 1966 24 p refs
(Contract AT(40-1)-3208)
(EURAEC-1806; QR-10; Rept.-438-10) CFSTI: HC $3.00/MF $0.65

Developments are reported for: production of thin foils of Type-304 stainless steel; etching procedure for Type-304 stainless steel; N_2 solubility in AISI Type-304 at 871 and 927°C; and thermodynamic properties of the solution process for N_2 in stainless steel. NSA

N67-28601# Naval Air Engineering Center, Philadelphia, Pa. Aeronautical Materials Lab.
METALLIC-CERAMIC AND INTERMETALLIC COMPOUNDS BY THE FLOATING ZONE TECHNIQUE Progress Report, 1 Oct. 1965–30 Sep. 1966
Marshall K. Thomas, Jr. 6 Mar. 1967 23 p refs
(NAEC-AML-2559; PR-1; AD-651191) CFSTI: HC $3.00/MF $0.65

The use of the floating zone process for the preparation of refractory materials is discussed. This process has been used to prepare columbium-aluminum oxide cermets and the intermetallic compound nickel aluminide (NiAl). Small amounts of aluminum oxide harden columbium and higher concentrations of aluminum oxide form a series of metallic and non-metallic phases. Zone melting a nickel tube with an aluminum rod inside it has resulted in a small amount of what appears to be NiAl. Author (TAB)

N67-28611# Raytheon Co., Waltham, Mass. Research Div.
CHEMICAL VAPOR DEPOSITED MATERIALS FOR ELECTRON TUBES Quarterly Report, 15 Nov. 1966–14 Feb. 1967
S. R. Steele, J. Pappis, H. Schilling, and L. Hagen Apr. 1967 57 p refs
(Contract DA-28-043-AMC-01343(E))
(S-936; ECOM-01343-7; QR-7; AD-651021) CFSTI: HC $3.00/MF $0.65

The program was established to investigate chemical vapor deposition as a method of producing materials or coatings for use in vacuum electron devices and microwave tubes. Isotropic CVD-BN has been deposited on W-RE wire for use as an encapsulated heater. The wire was brittle after deposition, but the coating was intact and exhibited good heat transfer capability. Multilayered structures of ZrB2 and isotropic CVD Bn have been deposited in a solenoid-controlled vapor deposition setup. The correct process conditions have been determined to achieve good layer adherence and uniformly thick layers of the proper thickness in 1in. pipe mandrels. The investigation of sealing methods for joining CVD BN to glasses and metals has been continued. The active metal process is promising for isotropic BN-to-metal seals, as is a metallizing mixture of 70% Mo, 21% Ni, and 9% Ti fired in vacuum. Seals to glass have been obtained with a silicon resin and with solder glass. Recommendations are made for procedures for cleaning and machining CVD BN. The optical transmission of several samples of isotropic CVD BN has been measured as a function of wavelength between 0.4 and 15 microns. In all samples strong absorptions are obtained between 7 to 8 microns and 12 to 13 microns. The largest differences from sample to sample are seen at 0.9 microns, and the strongest absorption at this wavelength is seen in a sample identified by X-ray diffraction as mostly rhombohedral BN. Optical absorption at 0.9 microns, coupled with physical density, seems to be a good measure of the quality of isotropic CVD BN for most electron device applications. Author (TAB)

N67-28616# Harvard Univ., Cambridge, Mass. Gordon McKay Lab.
OPTICAL PROPERTIES OF EPITAXIAL PbS FILMS IN THE ENERGY RANGE 2–6 eV Interim Technical Report
Charles E. Rossi Jan. 1967 35 p refs
(Contract Nonr-1866(10); ARPA SD-88)
(HP-17; ARPA-28; AD-651215) CFSTI: HC $3.00/MF $0.65

The reflectivity of epitaxial PbS films was compared with the reflectivity of bulk PbS in the energy range 2.1 to 6.2 eV and found to agree in both magnitude and structure within a few percent at energies where interference effects can be neglected. The transmission of several films with thicknesses varying from 335 A to 550 A has been measured and the structure and shape of the spectra shown to be the same for the films with different thicknesses. The reflectivity of bulk PbS between 2.1 and 6.2 eV has been combined with measurements made by other workers outside of this range to compute optical constants from the Kramers Kronig relation. The optical constants obtained in this manner appear to agree quite well with those obtained from the reflectivity and transmission of the films, considering the experimental difficulties experienced in measuring film thickness and the absolute magnitude of the reflectivity. Author (TAB)

N67-28621# Army Materials Research Agency, Watertown, Mass.
THE ANISOTROPY OF KNOOP HARDNESS IN UNALLOYED TITANIUM SHEET
Anthone Zarkades Jan. 1967 20 p refs
(AMRA-TR-67-04; AD-649516) CFSTI: HC $3.00/MF $0.65

Knoop hardness measurements were made on the major planes of two sheets of commercially pure titanium and one of iodide titanium. Anisotropy of hardness was found to exist in the three unalloyed polycrystalline titanium materials tested. Each textured material manifested hardness variations on the major planes of the sheets and the harness measured in each instance was dependent on the orientation of the Knoop indenter. Further evidence of Knoop hardness variations caused by preferred orientation was found in the hardness difference existing between the rolling and cross-section planes. Author (TAB)

N67-28640# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MATTING OF ALUMINUM AND ITS ALLOYS
S. I. Shames 17 Mar. 1967 15 p refs Transl. into ENGLISH from Russian Reports of 1st InterVUZ Conf. Anodic Protection of Metals, Moscow, 1964 p 222–232
(FTD-MT-65-395; AD-651088) CFSTI: HC $3.00/MF $0.65

The report covers a study of film formation kinetics and the properties of anodic oxide films produced in an oxalic acid electrolyte with the titanium salt TiO(KC2O4)2. 2H2O on aluminum AD-1 and Al alloys AMtsM and D16-T (unclad). Samples were wiped with benzine, chemically degreased (bath compositions given, 3 min., 60-70C for unpolished and 3-5 min., 70-80C for polished samples), hot and cold water rinsed, bleached (1-2 min., 40-50% HNO3, 18-20C), then anodized (bath composition given). The optimal conditions were 55C and 40 min. at 2 a/sq dm or 30 min. at 3 a/sq dm. Corrosion resistance was high and increased with process duration. Increasing the pH to a value of 3 did not affect film quality. Corrosion resistance, abrasive and friction wear, hardness, volume resistivity and dielectric strength characteristics of these films were better than for standard oxide films produced in sulfate or oxalate baths. Author (TAB)

N67-28741*# National Aeronautics and Space Administration, Washington, D. C.
STRUCTURAL CERMET MATERIALS [METALLOKERAMICHESKIYE KONSTRUKTSIONNYYE MATERIALY]
I. D. Radomysel'skiy, V. N. Klimenko, and A. F. Zhornyak Jun. 1967 12 p refs Transl. into ENGLISH from Poroshkovaya Met., Akad. Nauk Ukr. SSR (Kiev), v. 6, Nov. 1966 p 27–36 Presented at 5th Republican Sci.-Tech. Conf. on Powder Met., Kiev, 29–30 Mar. 1966
(NASA-TT-F-11013) CSCL 11B

An assessment is made of cermets as substitutes for common carbon and alloyed steels, cast iron, and nonferrous metals in structural materials. Among the topics discussed are technical requirements for powdered metals used in the production of cermet machine parts, the technology of manufacturing cermet materials from various carbon steels and chromium steel, and treating and machining these materials to produce machine parts. A metal-powder chroming process and a process for producing water-resistant cermet steels with a heterogeneous structure are described. Author

N67-28742*# Farnham (Frank C.) Co., Philadelphia, Pa.
THE Cu–Fe SYSTEM [HET SYSTEEM Cu–Fe]
Bastiaan Knook Washington, NASA, Mar. 1967 8 p Transl. into ENGLISH from the Dutch
(Contract NASw-1497)
(NASA-TT-F-10834) CSCL 11F

The alloys were prepared by diluting two Cu–Fe base alloys with pure Cu, degassed to prevent oxidation of the Fe, in a liquid state. Then they were quenched rapidly with argon gas in order to keep as much of the Fe in solid solution as possible. Some separation at grain boundaries probably occurred. The alloy test strips were vacuum tempered. The specific resistance (ρ) of the Cu–Fe alloys at low temperatures was calculated from the measured resistances, and the temperature at which this specific resistance reaches a minimum determined. The portion of ρ attributable to Fe was found, and it seems that at low temperatures Fe exhibits a normal and an anomalous portion of ρ. The normal portion is practically temperature independent. The depth of the minimum varies slightly more rapidly than directly proportional to the concentration. Author

N67-28744*# Holman (John F.) and Co., Inc., Washington, D. C.
STUDY OF THE PHASE DIAGRAM OF TITANIUM-RICH ALLOYS OF THE SYSTEM Ti–Al [ISSLEDOVANIYE DIAGRAMMY RAVNOVESIYA BOGATYKH TITANOM SPLAVOV SISTEMY Ti–Al]
I. I. Kornilov, N. A. Volkova, Ye. N. Pylayeva, P. I. Kripyakevich, and V. Ya. Markiv Jun. 1967 11 p refs Transl. into ENGLISH from the book "Novyye Issledovaniye Titanovykh Splavov" Moscow, Izd. Nauka, 1965 p 48–55
(Contract NASw-1495)
(NASA-TT-F-11011) CSCL 11F

The resistivity and hardness of the alloys are measured, using methods of thermal, microstructural, dilatometric, and X-ray diffraction analysis. It is found that alloys containing from 0 to 30 percent Al undergo a transformation in the solid state at temperatures between 882° and 1250°, corresponding to a transition from a hexagonal, densely packed structure to a body-centered cubic structure. The existence of the compound Ti_3Al, which has an ordered hexagonal structure of the Mg_3Cd type, is confirmed. The presence of five phase transformations in the part of the system investigated in the solid state is established. On the basis of a study of a complex of properties and the structure of alloys undergoing long periods of annealing, a phase diagram of the system Ti–Al with the presence of the compound Ti_3Al is plotted. Author

N67-28748*# General Electric Co., Cincinnati, Ohio. Missile and Space Div.
COMPATIBILITY OF BIAXIALLY STRESSED D-43 ALLOY WITH REFLUXING POTASSIUM
R. W. Harrison Washington, NASA, Jun. 1967 45 p refs
(Contract NAS3-6012)
(NASA-CR-807) CFSTI: HC $3.00/MF $0.65 CSCL 11F

The purpose of the tests was to determine the effects of stress on corrosion of an advanced refractory alloy when the stress is sufficiently large to produce substantial creep. D-43 columbium-base alloy in the form of welded capsules was selected for the tests. The reflux capsules were tested under conditions which resulted in about 5% to 10% strain during a 500-hr to 2000-hr exposure period in the 2000° to 2200° F temperature range. The capsule wall was reduced in the potassium liquid region and in the vapor condensing region to provide gauge sections for measuring the extent of creep. This permitted moderate temperature adjustments during the initial phase of the testing to achieve the desired strain-time conditions. Post-test evaluation included metallographic examination of grain structure and micro-hardness; chemical analysis; and electron microprobe analyses of carbon, oxygen, nitrogen, tungsten, and zirconium content profiles. K.W.

N67-28781# Bureau of Mines, Rolla, Mo.
THE TUNGSTEN-COBALT SYSTEM FOR COMPOSITIONS TO 85 ATOMIC PERCENT COBALT
Leander A. Neumeier and James L. Holman Washington, D. C., Jun. 1967 41 p refs
(RI-BM-6956) CFSTI: HC $3.00/MF $0.65

Preparation of alloys by powder metallurgy methods is described, and the results of studies made by a combination of techniques involving microscopy, X-ray diffraction, thermal analysis, and dilatometry are discussed. The existence of μ–W_6Co_7 is confirmed. The W_6Co_7 phase forms peritectically at 1,685°±15° C by reaction of liquid with primary W; the peritectic melt is at 71 at. pct cobalt. The homogeneity range of μ–W_6Co_7 extends to both sides of the ideal stoichiometric ratio, through a compositional range of about 5 at. pct. The compositional limits for μ–W_6Co_7 vary slightly below 1,471°±5° C, the temperature of the eutectic reaction forming μ–W_6Co_7 plus α. The eutectic composition is at 79 at. pct cobalt. The existence of WCo_3 is confirmed. WCo_3 forms peritectoidally at 1,093°±5° C by reaction between α and μ–W_6Co_7 and exists over a narrow homogeneity range of 0.5 to 0.6 at. pct. The solid solubility of cobalt in tungsten is low (maximum 0.9 at. pct cobalt) and results in contraction of the tungsten lattice. Tungsten is extensively soluble in α–Co at higher temperatures; the α–Co lattice is expanded by the presence of tungsten in solid solution. Author

N67-28788*# Union Carbide Corp., Parma, Ohio. Carbon Products Div.
HIGH TEMPERATURE PROTECTIVE COATINGS FOR REFRACTORY METALS Progress Report, 21 Jan.–21 Apr. 1967
J. Rexer 21 Apr. 1967 19 p refs
(Contract NASw-1405)
(NASA-CR-84828; PR-4) CFSTI: HC $3.00/MF $0.65 CSCL 11F

Iridium–molybdenum diffusion couples were hot pressed, and sections of the couples were heat treated at 1300°, 1530°, 1710°, and 1900° C. Some success was achieved in developing a two step color tinting method for revealing the molybdenum–iridium reaction zone. Select specimens were also examined with an electron microprobe analyzer. Several niobium and tantalum sheet samples were electroplated with nickel from an aqueous electrolyte. Iridium was then electroplated, from the molten cyanide electrolyte, on to the nickel. Author

N67-28796*# Melpar, Inc., Falls Church, Va. Materials Lab.
THE DEVELOPMENT OF DISPERSION-STRENGTHENED NICKEL-BASE CORROSION-RESISTANT ALLOYS
May 1967 16 p refs
(Contract NAS3-7271)
(NASA-CR-54580) CFSTI: HC $3.00/MF $0.65 CSCL 11F

The results of a program to produce a 70 nickel–20 chromium–10 molybdenum alloy by vapor plating in a fluidized bed of oxide particles are described. The nickel vapor was obtained by thermally decomposing nickel carbonyl, $Ni(CO)_4$. The chromium vapor was obtained by decomposing dicumene chromium, $Cr(C_9H_{12})_2$, and the molybdenum vapor was obtained by reducing molybdenum pentachloride, $MoCl_5$. Single and multi-element alloys were made. Metallographic examination of single-element deposit agglomerates of chromium or nickel showed a uniform particle distribution. Production of the triple-element dispersion-strengthened alloys by vapor deposition in a fluidized bed proved unsuccessful. The triple alloys were characterized by unusually high carbon contents, owing chiefly to the apparent decomposition of the carbonyl radical and carbon monoxide carrier gas used in vapor plating the nickel. The triple-element matrix alloys were also characterized by the presence of agglomerated oxide particles. These studies indicate that it is possible to vapor plate submicron oxide particles with either nickel or chromium and to obtain uniform fine oxide dispersions. The results of adding the nickel by an alternative method are also discussed. Author

N67-28834*# Aluminum Co. of America, New Kensington, Pa. Physical Metallurgy Div.

STUDY OF CRACK INITIATION PHENOMENA ASSOCIATED WITH STRESS CORROSION OF ALUMINUM ALLOYS Quarterly Report, 26 Dec. 1966–25 Mar. 1967

M. S. Hunter 24 Apr. 1967 101 p refs

(Contract NAS8-20396)

(NASA-CR-84850; QR-3) CSCL 11F

X-ray diffraction analyses of phases present in contract materials were completed and electron microprobe analyses of the 7075 alloy were made. The microprobe revealed certain heterogeneities but no indication that these were related directly to stress corrosion behavior. The attack on prepolished surfaces and in cross sections was similar, penetration in depth being much slower than stress-corrosion cracking rates. Light microscopy of crack initiation in the special tuning-fork specimen of most materials stressed short transversely to 75% YS was completed. In 2219-T37, cracks started and grew primarily on boundaries oriented normal to the stress. Preliminary investigations of the effect of stress level indicated that cracks develop in the same manner with 75% YS and 90% YS stresses but that localized surface deformation is much greater at the higher level. Author

N67-28935*# General Electric Co., Philadelphia, Pa. Missile and Space Div.

INVESTIGATION OF THE REINFORCEMENT OF DUCTILE METALS WITH STRONG, HIGH MODULUS DISCONTINUOUS, BRITTLE FIBERS Quarterly Report, 1 Feb.–30 Apr. 1967

A. Gatti, J. M. Berry, J. J. Gebhardt, and E. Feingold May 1967 47 p refs

(Contract NASw-1543)

(NASA-CR-84872; QR-2; Rept.-2410-2E2) CSCL 11F

The purpose of this program is to define and investigate the critical factors affecting the reinforcement of ductile metals with short, brittle fibers. The materials systems selected for study are aluminum (or its alloys) and "ductile" epoxies reinforced with B_4C whiskers or with high modulus filaments, such as, B_4C/B/W, SiC/W, B/W, etc. Related tasks in the program include the development of a more economical process for growing B_4C whiskers, deposition studies, the production of B_4C fibers, and the characterization of the individual constituents in the final composites. The latter task involves a study of the structural and chemical interactions of the combined elements (fibers, matrix, coatings, etc.) Author

N67-28958# Pennsylvania State Univ., University Park. Ordnance Research Lab.

THE DEPENDENCE OF INTERNAL MECHANICAL LOSSES ON STRESS AMPLITUDE IN COMMON PIEZOCERAMICS

R. W. Taylor 1 Mar. 1967 65 p refs

(Contract NOw-65-0123-d)

(AD-650474) CFSTI: HC $3.00/MF $0.65

The internal mechanical losses at high dynamic stress levels were investigated for low loss Barium Titanate and high and low loss Lead Zirconate Titanate. The mechanical losses were described by the mechanical quality factor, Q sub M, which was measured by the conventional resonance method. High dynamic stress amplitudes were achieved through unloaded operation at resonance. Several geometries and coupling modes were employed to determine the effect of these parameters. Over a stress range of 20,000,000 N/sq M, 1/Q sub M of high and low loss Lead Zirconate Titanate increased nonlinearly by factors of four and five, respectively. 1/Q sub M for low loss Barium Titanate exhibited little dependence on stress amplitude over this same range. For all materials, the stress--1/Q sub M relationship was independent of geometry and coupling mode. The empirically determined relationship between stress and 1/Q sub M was used to predict the efficiency and internal power dissipation resulting from a resonant sound projector operated at high drive levels. The decrease in mechanical to acoustical conversion efficiency was insignificant, while the increase in internal heating may be considerably more significant. In addition, the 1/Q sub M--stress relation was shown to be closely related to the relationship between electrical loss tangent and electric field. Author (TAB)

N67-28977# Westinghouse Electric Corp., Pittsburgh, Pa. Research Labs.

STUDIES ON THE HIGH TEMPERATURE OXIDATION OF MOLYBDENUM, TUNGSTEN, NIOBIUM, TANTALUM, TITANIUM, AND ZIRCONIUM Final Report

E. A. Gulbransen, K. F. Andrew, and F. A. Brassart 18 Apr. 1967 69 p refs

(Contract DA-31-124-ARO(D)-196)

(AROD-4067-3-MC; AD-650638) CFSTI: HC $3.00/MF $0.65

The purpose of these studies was twofold: (1) to extend and develop vacuum microbalance and electron diffraction methods for studying fast oxidation reactions of high temperature metals and solids under carefully controlled conditions of temperature, pressure, and gas flow; and (2) to determine the kinetics and mechanisms of oxidation of a number of high temperature metals and solids. TAB

N67-28978# Avco Corp., Lowell, Mass. Space Systems Div.

DEVELOPMENT AND EVALUATION OF TRANSPARENT MAGNESIUM OXIDE Final Report, 15 Oct. 1965–15 Nov. 1966

William H. Rhodes, David J. Sellers, and Thomas Vasilos Watertown, Mass., Army Mater. Res. Agency, Feb. 1967 60 p refs

(Contract DA-19-066-AMC-291(x))

(AVSSD-0168-67-RR; AMRA-CR-67-01; AD-650621) CFSTI: HC $3.00/MF $0.65

The densification parameters for hot pressing MgO to a theoretically dense polycrystalline body was studied. Two experimental approaches were followed; using pure MgO powders, and pressing mixtures of MgO plus small amounts of LiF. In the former case specimens having 60% total transmission (adequate for in line observation) were obtained by very precise control of the fabrication conditions followed by a long term anneal in hydrogen. The MgO - LiF process yielded thin specimens having 85% total transmission in the visible, and 3/8 inch thick specimens possessing a maximum transmission of 70%. A post hot pressing anneal at temperatures greater than 1200C and heating rates less than 28C/hour were required to produce maximum transparency. Evidence obtained by grain growth studies, weight loss experiments and lattice parameter determinations suggest that the densification mechanism for this process was pressure-enhanced diffusion through a solid solution grain boundary layer and a grain boundary phase. At temperatures above the melting point of LiF a pressure-enhanced liquid phase sintering mechanism probably operates.

Author (TAB)

18 MATERIALS, NONMETALLIC

Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

N67-27786 Gt. Brit. Ministry of Aviation, London. Technical Information and Library Services.
APPLICATION OF PYROLYTIC GRAPHITE IN THE CONSTRUCTION OF NOZZLE THROATS [APPLICATION DU GRAPHITE PYROLYTIQUE DANS LA CONSTRUCTION DES COLS DE TUYERES]
R. Cauville Jan. 1967 18 p Transl. into ENGLISH from Ann. Mines (France), Oct.–Nov. 1966 p 926–936
(TIL/T-5720) CFSTI: HC $3.00/MF $0.65

The requirements for the throats of liquid or solid propellant rockets are summarized and the characteristics of graphites described in relation to these. The methods of fabricating throats from pyrolytic graphite are discussed and examples of tests and their numerical results are presented. Author

N67-27909# Northwestern Univ., Evanston, Ill.
COMPUTER SOLUTION OF GEL-CROSSLINK RELATIONS
H. Y. Kang, O. Saito, and M. Dole 20 Dec. 1966 8 p refs Presented at 153rd Natl. Meeting, Am. Chem. Soc., Miami Beach, Fla.
(Contract AT(11-1)-1088)
(COO-1088-25; CONF-670401-4) CFSTI: HC $3.00/MF $0.65

When a polymer such as polyethylene is subjected to ionizing radiations, covalent bond crosslinks are formed in the solid at room temperature and chain degradation may also occur. However, all mathematical relations deduced to date have failed to be quantitatively applicable, chiefly because they have not been derived for the type of molecular weight distribution that exists in linear polyethylene. A theoretical treatment similar to that of Inokuti, but one based on the Wesslau molecular weight distribution, was carried out. The resulting very complicated equations were solved with considerable success using a CDC-3400 computer, and give the general shape of the dose–gel curve. The initial slope of the dose–gel curve was a sensitive function of the type of molecular weight distribution and the G-value for crosslinking increased with dose. Author (NSA)

N67-27910# Northwestern Univ., Evanston, Ill.
TEMPERATURE COEFFICIENT OF CROSSLINKING AND OTHER EFFECTS IN THE IRRADIATION OF POLYETHYLENE
H. Y. Kang, O. Saito, and M. Dole 1 Jan. 1967 8 p refs Presented at 153rd Natl. Meeting, Am. Chem. Soc., Miami Beach, Fla.
(Contract AT(11-1)-1088)
(COO-1088-26; CONF-670401-3) CFSTI: HC $3.00/MF $0.65

A study was made of the temperature coefficient over the range from 35 to 120°C of the radiological processes that occur during the gamma irradiation of polyethylene. To calculate crosslinks from gel–dose data use was made of the Charlesby–Pinner function as modified for a Wesslau molecular weight distribution. Good agreement of the data with the resulting equations was obtained in the case of the initial slope and general shape of the $s+s^{1/2}$ versus dose curve. Deviations at high doses were shown quantitatively to be related to vinylene decay; definite evidence of change of G(X) with dose was obtained. G(X) at zero dose was almost independent of temperature, but at the highest dose studied, 27 MRAD, G(X) increased significantly with temperature. Hydrogen yields increased slightly with temperature, but at the highest temperature, 120°C $G(H_2)$ was practically independent of dose. Material balance was realized to ±0.2 G-units at 35°C and to ±0.1 at 120°C both at zero and 27 MRAD dose. Author (NSA)

N67-27939# Royal Aircraft Establishment, Farnborough (England).
THE CHARACTERISATION OF ETHYLENE-PROPYLENE VULCANISATES
B. B. Moore and D. K. Thomas Dec. 1966 22 p refs
(RAE-TR-66388) CFSTI: HC $3.00/MF $0.65

Stress-strain measurements on dry rubbers are not a good method of characterising ethylene-propylene vulcanizates. Similar measurements on rubbers swollen to equilibrium in n-heptane show excellent agreement with the requirements of the kinetic theory of rubberlike elasticity in both tension and compression, and therefore represent the best means of determining the elastic constant directly. A single point method has been developed for evaluating the elastic constant in compression. Existing methods of analysing compression modulus data are shown to be unsuitable for the EP vulcanizates covered by the present work. Author (ESRO)

N67-28085# Institute of Modern Languages, Inc., Washington, D. C.
CURING OF EPOXY RESINS WITH COLLOIDAL LEAD [OTVERZDENIE SMOL COLLOIDKYM SVINZOM]
E. M. Natanson, Yu. I. Khimchenko, and Z. R. Ulberg Feb. 1967 10 p refs Transl. into ENGLISH from Akad. Nauk Ukr. SSR Modifikatsiya Svoystv Polimerow i Polimernykh Materialov (Kiev), 1965 p 119–124
(Contracts DA-44-009-AMC-1563(T); DA-ICOZ-4401-A-32A)
(ERDL-T-1893-67; TT-67-61264; AD-648403) CFSTI: HC $3.00/MF $0.65

New materials, representing homogenized, stably aggregated systems are formed during the development of colloidal particles by electrolytic or thermal decomposition of lead formate methods in the presence of epoxy resins. The presence of colloidal lead in such systems results in their curing under heating. Author (TAB)

N67-28090# IIT Research Inst., Chicago, Ill.
A STUDY OF THE ZIRCONIA–SCANDIA SYSTEM Final Report, 1 Oct. 1965–30 Sep. 1966
Robert F. Domagala Nov. 1966 27 p refs
(Contract AF 33(615)-3280)
(ARL-66-0230; AD-649380) CFSTI: HC $3.00/MF $0.65

A tentative diagram for phase relationships in the ZrO2-Sc2O3 system is presented based principally on metallographic analysis of as-cast and annealed specimens of ingots prepared by arc melting together calculated amounts of ZrO2 and Sc2O3. A melting point vs. composition study and a somewhat cursory X-ray investigation were conducted; data from these studies are incorporated in the presentation. Briefly, the ZrO2 -rich region of the system has been left open, since further study is required to define relationships in this portion of the diagram. Two intermediate phases, one at approximately 25 w/o (approximately 23.0 m/o) Sc2O3 (designated gamma) and one at 32 w/o (29.6 m/o) to 42 w/o (39.3 m/o) Sc2O3 (Designated delta), have been positioned. A eutectic L approaches limit of delta + Sc2O3 solid solution has been placed at approximately 55 w/o (52.2 m/o) Sc2O3 and 2450C. There is a broad solubility of Sc2O3 for ZrO2; a single-phase field exists from 77 w/o (74.0 m/o) Sc2O3 to 100% Sc2O3. Author (TAB)

N67-28188# Case Inst. of Tech., Cleveland, Ohio.
AN INHERENTLY FIBROUS ORGANOSILICON POLYMER
S. F. Frazier, J. A. Bedford, J. Hower, and M. E. Kenney 19 Mar. 1967 17 p refs Prepared jointly with Western Reserve Univ.
(Contract Nonr-1141(18))
(TR-5; AD-649281) CFSTI: HC $3.00/MF $0.65

The reaction of chrysotile with hydrochloric acid and chlorotrimethylsilane has yielded a stable organosilicon polymer consisting of ribbons which are curled up along their long axes into fibers. The dimensions of the fibers approximate those of chrysotile. Exposure of the fiber rolls to organic solvents causes them to uncoil. Author (TAB)

N67-28259# Forest Products Lab., Madison, Wis.
MEASUREMENT OF UNIAXIAL CREEP OF SELECTED ADHESIVES IN FREE FILM FORM
S. J. Tellman, D. Kutscha, and V. R. Soper Mar. 1967 40 p refs Prepared in cooperation with Wisconsin Univ.
(FPL-0157; AD-649304) CFSTI: HC$3.00/MF$0.65

Satisfactory performance of adhesive-bonded wood joints results from the application of sound engineering principles and a knowledge of the mechanical behavior of the materials involved. The report describes techniques for measuring the creep of adhesives in free film form when dead loaded in tension. Creep measurements, made on selected adhesives, illustrated that adhesives differ widely in their ability to deform elastically and plastically under load. Better joint design for specific end uses can result upon considering the creep behavior of the adhesives employed. Author (TAB)

N67-28290* Scientific Translation Service, La Canada, Calif.
INFLUENCE OF HIGH TEMPERATURES ON THE STRENGTH OF SOLIDIFIED RESINS AND MATERIALS BASED ON RESINS [VLIYANIYE POVYSHENNYKH TEMPERATUR NA PROCHNOST' OTVERZHDENNYKH SMOL S GETERO-ATOMOM V SOSTAVE ZVEN'YEV]
Ye. B. Trostyanskaya, V. U. Novikov, and Yu. N. Kazanskiy Washington, NASA, May 1967 10 p refs Transl. into ENGLISH from Mekh. Polimerov, Akad. Nauk Latv. SSR (Riga), no. 5, 1966 p 746–754
(Contract NASw-1496)
(NASA-TT-F-10934) CSCL 11I

The previously established linear dependence between decreasing strength and loss of weight is supported by the investigation of solidified phenol-formaldehyde, phenol-phosphoric, melamin-formaldehyde and silicon-organic resins. Three qualitatively different stages are observed in the process of thermodestruction. The first stage with a significant loss of weight is characterized by a decrease of strength pointing to the high intensity of the structural net of solidified resins. The second stage with a gradual change of strength and weight points to the thermo-oxidizing destruction which, in the case of phenol-phosphoric and melamin-formaldehyde resins, results in the formation of stable structures (the third stage) with residual strength of 8–10%. The structural elasticity helps to increase the workability of solidified resins under high temperature. We suggest that the thermostability of resins be evaluated by spatial diagrams in the coordinates "strength–temperature–time" Author

N67-28331# Naval Research Lab., Washington, D. C.
INFRARED SPECTRA OF PLASTICS AND RESINS. PART 3: RELATED POLYMERIC MATERIALS (ELASTOMERS)
Dorothy S. Cain and Suzanne S. Stimler 28 Feb. 1967 33 p refs
(NRL-6503; AD-649004) CFSTI: HC$3.00/MF$0.65

Infrared spectra of thin films of 47 elastomers were obtained in the region from 400 to 4000/cm. The elastomers studied were uncured natural and synthetic rubbers, chosen as representative of the various classes of rubbers. The identification chart presented PB-111 438 and AD-634 427 was expanded to include the elastomers studied here, in addition to the plastics used in that work. The use of this expanded chart and the reference spectra should make it possible to determine from the infrared spectrum of an unknown polymer its class or type. Author (TAB)

N67-28441# Atomic Energy Commission Research Establishment, Riso (Denmark).
USE OF POLYVINYL-CHLORIDE FILM FOR ELECTRON BEAM DOSIMETRY
Jovanka Ilic-Popovic Sep. 1966 18 p refs
(RISO-141)

The suitability of a homopolymer type of PVC film (OCA-5960, 0.015" thick) as a high-dose electron dosimeter (1–5 Mrads) was investigated. Different heat treatments were applied in order to obtain a reasonable storage stability and an approximately linear relationship between optical density and dose over the dose range from 0.5 to 5 Mrads. The spectral range was 3900 to 5000 Å. The effect of the dose rate on the coloration of PVC was studied. Author (NSA)

N67-28461# Westinghouse Electric Corp., Pittsburgh, Pa.
A STUDY AND OBSERVATIONS OF SINTERED URANIUM AND THORIUM OXIDES
A. Bassi, E. Brutto, G. Perona, and R. Sesini [1967] 30 p refs Transl. into ENGLISH from Energ. Nucl. (Milan), v. 13, 1966 p 122–132 Presented at Conf. on Fissile Mater. in Nucl. Reactors, Milan, 29 Nov.–1 Dec. 1965
(WAPD-TRANS-41; CONF-651151-1)

Mixed urania and thoria are of interest for use in reactors. The same methods as those used for UO_2 pellets were considered to be fitted to the fabrication of composed pellets, starting from suitably mixed powders of the two oxides. Some sintered pellets were prepared at high temperature and with different times. The sintered materials were submitted to metallographic observation and thermal shock tests in order to control their mechanical properties. Mixtures with a high content of either components give rise to good quality homogeneous materials. Two different phases seem to be present in the intermediate composition mixtures; sintered oxides present a marked porosity, nevertheless the thermal shock resistance is so high that uses of these materials can also be foreseen. Microfractography by means of direct carbon replicas was used and a new technique for transmission observation in electron microscope was developed in order to clarify the morphology of this material. Author (NSA)

N67-28479# Sandia Corp., Livermore, Calif.
LITERATURE SURVEY OF CARBORANE CONTAINING POLYMERS
R. W. Weaver Feb. 1967 30 p refs
(Contract AT(29-1)-789)
(SCL-DR-67-11) CFSTI: HC$3.00/MF$0.65

A survey of the literature of carborane-containing polymers was made. The work of five companies in this field is reviewed. A bibliography of 138 articles and 49 patents is included. Author (NSA)

N67-28662*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MATERIALS RESEARCH
In its Res. and Advanced Develop., Vol. II 31 Jan. 1967 p 539–578 refs (See N67-28641 15-34)

Ceramics, carbon and graphite, polymers, and solid state materials are investigated. The role of grain boundaries and associated impurities in the deformation and fracture of polycrystalline ceramics is being studied. Deformation, stress dependence of creep rate, elastic properties, kinetics of graphitization, magnetic susceptibility are investigated in connection with polycrystalline carbons and graphites. A project on the thermostability of polymers at high temperature reports progress in polymer synthesis and isostatic compression; energy transfer in certain aromatic polymers and the electrical properties of polymers are under consideration; and the operation of a torsion pendulum at liquid helium temperatures and the rheological properties of polymers are being investigated. Progress is reported for high resolution nuclear magnetic resolution problems and instrumentation; thermoelectric power in metals and alloys, niobium–zirconium alloys, and tunneling through very thin oxide films; and on lunar dust generation, transport, and adhesion. M.W.R.

N67-28688# Edo Western Corp., Salt Lake City, Utah.
IMPACT SHOCK ON PIEZOELECTRIC CERAMICS Final Report, 1 May 1965–30 Apr. 1967
Colin W. Skinner, William T. Kiyota, and Richard C. Lowrie 1 May 1967 104 p refs
(Contract Nonr-4917(00))
(Rept.-11003-9; AD-651100) CFSTI: HC $3.00/MF $0.65

Life expectancy tests performed on ceramic rings of compositions EC-55, EC-64, EC-65 and EC-69 have resulted in extensive data regarding the effects of impact shocks on the physical and electrical characteristics of the ceramic rings. The results have indicated that the dissipation and the mechanical Q of the ceramic were the parameters most affected by impact shocks. The dielectric constant was the only electrical characteristic that remained stable under impact shock. Ceramic rings of composition EC-65 were able to withstand higher and more impact shocks than rings of the other three compositions. The results on composition EC-69 indicated that this composition has the lowest mechanical strength with respect to impact shock. The results obtained from life expectancy tests performed on ceramic discs and rings were in agreement regarding the effects of impact shock on their electrical characteristics. The mechanical strength of the ceramic ring configuration was better than that of the ceramic disc configuration. This was true for all four ceramic compositions studied. Author (TAB)

N67-28755*# Boeing Co., Seattle, Wash. Aerospace Group.
COMPATIBILITY OF POLYMERIC FILMS WITH LIQUID OXYGEN
J. T. Hoggatt Jan. 1967 30 p refs
(Contract NAS3-7952)
(NASA-CR-72134) CFSTI: HC $3.00/MF $0.65 CSCL 11I

Liquid oxygen impact sensitivity levels were determined for single and multi-ply Mylar, Kapton and FEP Teflon coated Kapton polymeric film samples. The effects of stacking; the addition of a TFE Teflon fabric cushioning ply; and long term LOX exposure were determined. Author

N67-28777*# Stanford Research Inst., Menlo Park, Calif.
EXPERIMENTAL AND ANALYTICAL STUDIES OF RADIATION-ONLY PYROLYSIS OF MODEL CHAR-FORMING POLYMERS Annual Summary Report
E. M. Liston 20 Jul. 1966 48 p
(Contract NAS7-341; SRI Proj. FRU-5340)
(NASA-CR-84806; AR-1; Rept.-14) CSCL 11I

A summary is presented of continuing research in the physical behavior, reaction mechanisms, and reaction rates involved in the pyrolysis of charring ablation-type polymers under radiation-only, one-dimensional heating. The major portion of this effort was directed toward the design and construction of the test apparatus. Sufficient experiments have been performed to show that the equipment is performing its design functions. The data obtained from these experiments have been used toward characterizing the pyrolysis behavior of several model polymer systems. The major findings concern the effect of small amounts of reinforcement on the stability of the polymer during the char-forming process. Author

N67-28882# Institute of Modern Languages, Inc., Washington, D. C. Translation and Interpretation Div.
GLASS IMMUNE TO FUMES OF ALKALI METALS [STEKLO USTOICHIVOYE K PARAM SHCHELOCHNYCH METALLOV]
L. F. Shumitskaya, M. L. Gd'dfarb, and V. K. Tuzova Mar. 1967 4 p Transl. into ENGLISH from Byul. Izobret. i Tovarnykh Znakov (Moscow), v. 22, no. 3, 1966
(Contract DA-44-009-AMC-1563(T))
(T-1896-67; TT-67-61266; AD-648405) CFSTI: HC $3.00/MF $0.65

The glass consists of the following percents by weight: SiO2 12 plus or minus 2, B2O3 32 plus or minus 2, Al2O3 32.5 plus or minus 2, CaO 20 plus or minus 1.5, SrO 3.5 plus or minus 1.5 and contain not more than 0.03% Fe2O3. The glass does not crystallize during founding and working, it can be worked out well in the flame of a torch, articles with a wall thickness of 0.2-0.4 mm can be made of it, and it can be vacuum soldered to Kovar and molybdenum. TAB

N67-28897# Pennsylvania State Univ., University Park. Materials Research Lab.
RELATION OF MECHANICAL PROPERTIES TO THE STRUCTURE OF IONIC SOLIDS Quarterly Technical Report, 1 Dec. 1966–28 Feb. 1967
K. Vedam and V. Vand 20 Mar. 1967 15 p refs
(Contract DA-19-0660-AMC-325(X))
(AMRA-CR-66-07/3; QTR-3; AD-649351) CFSTI: HC $3.00/MF $0.65

Measurements on the stress-strain relation in muscovite mica indicate that dislocations are mobile even at very low stress levels at room temperature. Irradiation with gamma-rays to 10 to the 7th power R did help to pin the dislocations but not completely. Etch pit studies indicate that it is the dislocations which lie and operate entirely in the (001) plane, dominate the mechanical properties of mica at low stress levels. Detailed x-ray crystal structure analysis of IM Fluorophlogopite is in progress. Author (TAB)

19 MATHEMATICS

Includes calculation methods and theory; and numerical analysis. For applications see: 08 Computers.

N67-27874 Technische Hochschule Stuttgart (West Germany).
A NEW NUMERICAL METHOD FOR THE SIMULTANEOUS COMPUTATION OF THE EIGENVECTORS AND EIGENVALUES OF ARBITRARY DYNAMICAL MATRICES [DIE SIMULTANE BERECHNUNG VON EIGENVEKTOREN UND EIGENWERT SPEKTREN BELIEBIGER DYNAMISCHER]
Peter C. Patton 6 Dec. 1966 135 p refs

Consideration is given to the development of a numerical method for the solution of algebraic eigenvalue problems arising in the matrix analysis of structures; for example, buckling, free vibration, more general aeroelastic phenomena such as flutter, and solution of orthogonal and near-orthogonal redundancies in the force method of structural analysis. Of particular interest is the eigenreduction of dynamical matrices, i.e., the determination of free modes of vibration in complex structures with or without damping. The algorithm described in this report is the result of an attempt to combine the advantages of both the von Mises' and the Jacobi methods. It is based on the Rayleigh Quotient and is an iterative method with second-order convergence properties. The basic iteration for real symmetric matrices is described and derived in detail, and is extended to the method of Hermitian matrices and to normal and normalizable matrices. An example is given in the form of flutter analysis of the Vickers VC10 transport aircraft. A general production program for the algorithm, written in Fortran IV, is also included. L.E.W.

N67-28009*# Innsbruck Univ. (Austria). Inst. of Theoretical Physics.

THE SOLUTION OF THE EULERIAN GYROSCOPE EQUATIONS BY MEANS OF LIE SERIES MAKING USE OF RECURRENCE FORMULAS

A. Schett and J. Weil [1966] 21 p refs

(Grant NGR-52-046-001)

(NASA-CR-84655; SR-14) CFSTI: HC $3.00/MF $0.65 CSCL 12A

The method of recurrence formulas is applied to solution of the Eulerian gyroscope equations by means of Lie series. The derivation of recurrence formulas for D^2z is given, and their effectiveness in the solution of several other types of differential equations, e.g., the general second-order differential equations, is shown. The formulas are very complex and no statements are made as to their usefulness in numerical calculations. S.P.

N67-28094# RAND Corp., Santa Monica, Calif.

AN ALGORITHM FOR IDENTIFYING THE ERGODIC SUBCHAINS AND TRANSIENT STATES OF A STOCHASTIC MATRIX

B. L. Fox and D. M. Landi Mar. 1967 26 p refs

(Contract F44620-67-C-0045; Proj. RAND)

(RM-5269-PR; AD-649384) CFSTI: HC $3.00/MF $0.65

A technique for quickly identifying the significant substructural relationships among states of a Markov chain, which is one of the simplest and most frequently used probability models. In applications, a Markov chain usually represents a physical system whose alternative modes of operation can be limited to a finite number of possibilities called states. The dynamics of such a system are specified by designating the probabilities governing its changes from one state to another over time; these probabilities together comprise the elements of a stochastic matrix, which is the natural vehicle by which Markov chains are represented. An algorithm for identifying the ergodic subchains and transient states of a stochastic matrix is presented. Applications in Markov renewal programming and in the construction of variable length codes are reviewed, and an updating procedure for dealing with certain sequences of stochastic matrices is discussed. The Fortran IV computer program for the algorithm is given as an appendix. Author (TAB)

N67-28130 Joint Publications Research Service, Washington, D. C.

PREDICTION ACCURACY ANALYSIS

M. I. Poteyev *In its* Izv. VUZov: Instr. Bldg., Vol. 9, No. 2 23 Feb. 1967 p 147–152 refs (See N67-28101 15-14)

A physical process, the characteristics of which are described by power polynomials of time is observed with the aid of a measuring instrument. According to the least square method a polynomial is determined with the best approximation to the process being observed, on the basis of which further course of the process is predicted. A relation is derived between probability characteristics of error in prediction and probability characteristics of measurement errors. Author

N67-28181# Wisconsin Univ., Madison. Mathematics Research Center.

ON THE AHLBERG–NILSON EXTENSION OF SPLINE INTERPOLATION: THE g-SPLINES AND THEIR OPTIMAL PROPERTIES

I. J. Schoenberg Nov. 1966 42 p refs

(Contract DA-31-124-ARO(D)-462)

(MRC-TSR-716; AD-649108) CFSTI: HC $3.00/MF $0.65

A new discussion of the properties of "the splines of interpolation" of Ahlberg and Nilson, "The approximation of linear functionals," J. SIAM on Numerical Analysis, June 1966, with particular emphasis on the important question of the unicity of the solutions of the several problems considered. Conditions for unicity are easily found once we realize that these extended spline functions, here called g-splines, are designed to generalize the interpolation problem first studied by G. D. Birkhoff in 1906. Author (TAB)

N67-28190# Brown Univ., Providence, R. I. Div. of Applied Mathematics.

FOURIER TRANSFORMS, GENERALIZED FUNCTIONS AND TWO CLASSES OF INTEGRAL EQUATIONS, PART I

Young-ping Pao Feb. 1967 27 p refs

(Contract Nonr-562(42))

(TR-3; AD-648672) CFSTI: HC $3.00/MF $0.65

This report is concerned with some Wiener-Hopf type integral equations for which the Fourier transforms of the solutions must be considered as generalized functions. The proper fundamental spaces are studied together with the structure of the generalized functions on these spaces. These results will be used in another paper to obtain the solutions to some Wiener-Hopf equations. TAB

N67-28253# Wisconsin Univ., Madison. Mathematics Research Center.

ON THE CALCULATION ON THE LARGEST EIGENVALUE OF AN INTEGRAL EQUATION

C. W. Cryer Oct. 1966 33 p refs

(Contract DA-31-124-ARO(D)-462)

(MRC-TSR-704; AD-649092) CFSTI: HC $3.00/MF $0.65

Two methods are given for obtaining computable bounds for the largest eigenvalue of a linear integral equation with a continuous, symmetric, and non-negative, kernel. Several numerical examples are presented. Author (TAB)

N67-28254# Wisconsin Univ., Madison. Mathematics Research Center.

TOTAL POSITIVITY OF SOME FUNCTIONS ASSOCIATED WITH MARKOV BRANCHING PROCESSES

P. C.-C. Wang and A. T. Bharucha-Reid Oct. 1966 13 p refs

(Contract DA-31-124-ARO(D)-462)

(MRC-TSR-717; AD-649094) CFSTI: HC $3.00/MF $0.65

Total positivity of the transition probabilities P sub ij(t) in the variables i and J implies the total positivity of the generating function F sub i(s,t) in the variables i and s. The converse is also considered. Author (TAB)

N67-28258# Boeing Scientific Research Labs., Seattle, Wash. Mathematics Research Lab.

ASYMPTOTIC REPRESENTATION OF THE CYCLE OF VAN DER POL'S EQUATION FOR SMALL DAMPING COEFFICIENTS

Andre Deprit and A. R. M. Rom Feb. 1967 26 p refs *Its* Mathematical Note No. 502

(D1-82-0598; AD-649562) CFSTI: HC $3.00/MF $0.65

The limit cycle of Van der Pols equation is expanded as a power series of the damping coefficient epsilon, the coefficients being finite trigonometric sums with the time as argument. Because the development was implemented in a fully automatic way on a computer, it has been pushed to a high power of epsilon. Hence, for epsilon as large as 0.75, the estimates given by the series for the amplitude and the period agree to 15 decimal places with their correct values computed on integrating by recurrent power series Van der Pols equation and its associated variational equation. When epsilon reaches 1.75, the agreement is still within 0.001. Author (TAB)

N67-28273# Wisconsin Univ., Madison. Mathematics Research Center.
THE MOMENTS AND CUMULANTS OF THE NUMBER OF CYCLES IN A RANDOM PERMUTATION
B. Harris Nov. 1966 12 p refs
(Contract DA-31-124-ARO(D)-462)
(MRC-TSR-700; AD-649090) CFSTI: HC $3.00/MF $0.65

The central moments and cumulants of the number of cycles in a random permutation on n elements are obtained and their asymptotic (n approaches limit of infinity) behavior is investigated. Author (TAB)

N67-28274# Wisconsin Univ., Madison. Mathematics Research Center.
ON APPROXIMATION OF ANALYTIC FUNCTIONS OF DOMAINS WITH SMOOTH BOUNDARY
V. K. Dzjadyk and D. M. Galan Nov. 1966 26 p refs Transl. into ENGLISH from Ukr. Mat. Zh. (Kiev), v. 17, 1965 p 26–38
(Contract DA-31-124-ARO(D)-462)
(MRC-TSR-712; AD-649078) CFSTI: HC $3.00/MF $0.65

For a function defined on a bounded region of the complex plane with smooth boundary it is shown how to construct a sequence of approximating polynomials so that the closeness of approximation depends on the modulus of smoothness of the approximated function. TAB

N67-28276# Frankford Arsenal, Philadelphia, Pa. Pitman-Dunn Research Labs.
ON A NONHOMOGENEOUS RANDOM DIFFUSION EQUATION
Edmund H. Inselmann Jan. 1967 9 p
(FA-TN-1117; AD-649174) CFSTI: HC $3.00/MF $0.65

This paper deals with the solution of random diffusion equations. The solution is obtained by using eigenfunction methods. The mean and all the correlation functions are computed. TAB

N67-28279# Wisconsin Univ., Madison. Mathematics Research Center.
SOLUTION OF SYSTEMS OF FREDHOLM EQUATIONS WITH GREEN'S MATRIX KERNELS
S. K. Aalto Nov. 1966 13 p refs
(Contract DA-31-124-ARO(D)-462)
(MRC-TSR-714; AD-649085) CFSTI: HC $3.00/MF $0.65

Systems of Fredholm equations with Greens matrix kernels are transformed to Volterra equations plus finite algebraic systems. Author (TAB)

N67-28328# Wisconsin Univ., Madison. Mathematics Research Center.
ON DIVERGENCE OF INTERPOLATION PROCESSES AT A FIXED POINT
A. A. Privalov Nov. 1966 27 p refs Transl. into ENGLISH from the Russian Rept.
(Contract DA-31-124-ARO-D-462)
(MRC-TSR-709; AD-649095) CFSTI: HC $3.00/MF $0.65

This paper extends previously known conditions under which the Lagrange interpolation process can fail to converge to the value of a continuous function at some point. TAB

N67-28501# Michigan Univ., Ann Arbor. Dept. of Communication Sciences.
ON HEREDITARY PROPERTIES OF GRAPHS
Stephen T. Hedetniemi Feb. 1967 14 p refs
(Contracts Nonr-1224(21); DA-31-124-ARO(D)-483; Grant NIH GM-12236-03)
(Rept.-6499.4-M; Rept.-03105-46-T; AD-649059) CFSTI: HC $3.00/MF $0.65

The point independence number of a graph G, beta sub 0 (G), is the maximum number of points in a set S such that no two points in S are adjacent in G. The point covering number, alpha sub 0 (G), is the minimum number of points in a set S such that every line of G contains a point of S. In 1959, Gallai proved the following very simple result. Theorem 1. For any graph G having p points, point covering number alpha sub 0 and point independence number beta sub 0, alpha sub 0+beta sub 0=p. This paper obtains several generalizations of this theorem which specify broad classes of properties p of a graph G corresponding to which there exist parameters alpha sub 0 (P) and beta sub 0 (P), such that for any graph G having p points, alpha sub 0 (P)+beta sub 0 (P)=p. We also obtain a theorem which specifies a similar class of properties Q of a graph G and corresponding parameters alpha sub 1 (Q) and beta sub 1 (Q) such that for any graph G having q lines, alpha sub 0 (Q)+beta sub 1 (Q)=q. Author (TAB)

N67-28502# Michigan Univ., Ann Arbor. Dept. of Communication Sciences.
SOME INTERPOLATION THEOREMS FOR PARTITIONS OF GRAPHS
Stephen T. Hedetniemi Mar. 1967 15 p refs
(Contracts Nonr-1224(21); DA-31-124-ARO(D)-483; Grant NIH GM-12236-03)
(Rept.-6499.3-7; Rept.-03105-47-T; AD-649062) CFSTI: HC $3.00/MF $0.65

The paper considers certain partitions of the set of points and of the set of lines of a graph and defines for each such partition a corresponding factor graph. The concepts of a complete P-partition and a complete P-line partition of order M are then defined for an arbitrary property P of a graph G. Two results are then obtained which answer the following questions: for what properties P of a graph G does it follow that if G has complete P-partitions (P-line partitions) or orders M and N, then G has complete P-partitions (P-line partitions) of orders K for any K, M<K<N. Author (TAB)

N67-28503# Michigan Univ., Ann Arbor. Dept. of Communication Sciences.
REALIZATION AND COMPLEXITY OF COMMUTATIVE EVENTS
Richard Laing Mar. 1967 44 p refs
(Contracts Nonr-1224(21); DA-31-124-ARO(D)-483)
(Rept.-03105-48-T; Rept.-6499.2-M; AD-649063) CFSTI: HC $3.00/MF $0.65

A measure of complexity is defined for a class of expressions denoting behaviors of commutative machines. For an expression of complexity M there is an M tape machine which realizes in real-time the event denoted. The machine realizations can be of many kinds; the 'simplest' realizations are those composed of finite counters of a single kind of input letter, combined with infinite state machines which check off numbers (Mod P) of one kind of input letter against numbers (Mod R) of a second kind of input letter. The state diagrams of the finite state machines are in the form of cycles (possibly with linear 'lead-ins'); the state diagrams of the infinite state machines graphically are infinite cylinders (possibly with two-dimensional lead in arrays). For any machine with M counter tapes (as here defined), an M-complex expression can be obtained which denotes the event which is the behavior of the machine. Finally it is shown that for all M there are M-complex expressions which require M-counter tape machines for realizing in real-time the events denoted. Author (TAB)

N67-28506# Wisconsin Univ., Madison. Mathematics Research Center.
A GENERAL PERRON INTEGRAL III
P. S. Bullen Nov. 1966 10 p refs
(Contract DA-31-124-ARO(D)-462)
(MRC-TSR-696; AD-649088) CFSTI: HC $3.00/MF $0.65

A necessary and sufficient condition for a lower semi-continuous function to be hyperharmonic. Author (TAB)

N67-28519# Oak Ridge National Lab., Tenn.
BIASES OF ESTIMATORS FOR THE NEGATIVE BINOMIAL DISTRIBUTION
K. O. Bowman and L. R. Shenton Nov. 1966 126 p refs
(Contract W-7405-ENG-26)
(ORNL-4005) CFSTI: HC $3.00/MF $0.65

The parametric form of the negative binomial distribution considered has mean $\hat{pk}$ and variance pk(p+l) and probability generating function $(1+p-pt)^{-k}$. It is well known that the maximum likelihood estimators p, k of p, k are biased. If the sample size is n the biases may be expanded as series in descending powers of n, the higher order terms being almost impossible to find. Presented is a tabulation of the terms in the series depending on n^{-1} and n^{-2}. The table may also be used for the asymptotic biases of two other well known parametrizations. Author

N67-28551# Boeing Scientific Research Labs., Seattle, Wash. Mathematics Research Lab.
CONVEX FUNCTIONS ON CONVEX POLYTOPES
David Gale (Calif. Univ.), Victor Klee, and R. T. Rockafellar Mar. 1967 15 p *Its* Mathematical Note No. 507
(Grants AFOSR-1202-67; NSF-GP-3579)
(DI-82-0607; AD-651157) CFSTI: HC $3.00/MF $0.65

The behavior of convex functions is of interest in connection with a wide variety of optimization problems. It is shown here that this behavior is especially simple, in certain respects, when the domain is a polytope or belongs to certain classes of sets closely related to polytopes; moreover, the polytopes and related classes are actually characterized by this simplicity of behavior. TAB

N67-28587# Naval Missile Center, Point Mugu, Calif.
SOME PROPERTIES OF RAYLEIGH DISTRIBUTED RANDOM VARIABLES AND OF THEIR SUMS AND PRODUCTS
C. O. Archer 7 Apr. 1967 40 p refs
(NMC-TM-67-15; AD-650090) CFSTI: HC $3.00/MF $0.65

Physical phenomena which can be described by the Rayleigh density function exist in many areas of study; e.g., noise theory, lethality, radar return, etc. This report gives some of the basic properties of the Rayleigh probability density function. It includes the functional relationships between the various parameters and graphical displays of these relationships. The density functions for the sum and the product of two Rayleigh distributed random variables and the relationships between their various parameters are described. Illustrations of the use of the density functions are given. Also included are complete tables of the Rayleigh density function and distribution. TAB

N67-28608# Army Electronics Labs., Fort Monmouth, N. J.
THEORY OF A PARALLEL-ACTING AUTOMATON
S. M. Amoroso Jan. 1967 210 p
(ECOM-2794; AD-651027) CFSTI: HC $3.00/MF $0.65

The report considers first a subclass of deterministic automata which are characterized by master control programs consisting of finite sequences of instructions. Machines of this subclass are called A sub p-machines. After investigating some of the basic properties of these A sub p-machines, it is shown that with respect to the task of string recognition, these automata are weaker than finite automata and equivalent to a variant of k-limited automata. The next subclass of automata considered is characterized by master control programs that are infinite sequences of instructions each composed of a finite initial sequence of instructions followed by a repeating cycle of instructions. Machines of this subclass are called B sub p-machines. It is shown that with respect to the task of producing (defining) sets of strings these machines are equivalent to a number of variant B sub p-machines, and it is shown that an arbitrary recursively enumerable set of strings can be produced on some B sub p-machines. The last subclass of these machines considered is characterized by the introduction of a conditional transfer in the master control programs. It is shown that these automata, that are called C sub p-machines, can compute with a very simple instruction set, any effectively computable function. Then it is shown that either limiting our parallel automata to one-way infinite chains, or to communication with neighboring machines of the chain in one direction only, does not limit their theoretical processing capabilities. Author (TAB)

N67-28618# Systems Research Labs., Inc., Dayton, Ohio.
TECHNIQUES IN INTRINSIC ANALYSIS Final Report, 1 Nov. 1965–31 Oct. 1966
Robert M. Colomb 30 Nov. 1966 69 p refs
(Contract AF 19(628)-5657)
(AFCRL-67-0153; AD-651071) CFSTI: HC $3.00/MF $0.65

Intrinsic analysis is a data reduction technique which allows a set of data vectors to be approximated to a given mean square error by a minimum number of coefficients. This report develops the analysis, showing the relation to other developments and proves several results about the relation between the row space and column space of matrices. The problem of error propagation and control is considered from several points of view and the effect of ambiguous data on the algebraic eigenvalue problem discussed. Finally, a survey is made of computational algorithms for the algebraic eigenproblem for large ambiguous second moment matrices, and two new algorithms proposed: one for very large matrices and the other for complex hermitian matrices. TAB

N67-28620# Boeing Scientific Research Labs., Seattle, Wash. Mathematics Research Lab.
OPTIMAL REPRESENTATION OF A FUNCTION AS A LINEAR COMBINATION OF FUNCTIONS
George Marsaglia Mar. 1967 14 p refs *Its* Math. Note No. 508
(D1-82-0610; AD-651148) CFSTI: HC $3.00/MF $0.65

This paper discusses the approximation of a given density function g(x) with a linear combination of densities f sub one (x), f sub two (x), ..., f sub n (x) in such a way that the approximation has maximum area but always lies below the given function. TAB

N67-28663*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
APPLIED MATHEMATICS
In its Res. and Advanced Develop., Vol. II 31 Jan. 1967 p 579–596 refs (See N67-28641 15-34)

Progress is reported under statistical emission, optimal control, perturbation, relativity, and probability theories; as well as for investigations in the computer sciences, primarily on the problem of data compression using polynomials. Lunar and planetary flight mechanics studies are concerned with celestial mechanics, astrodynamical and physical constants, planetary and lunar ephemerides improvement, and advanced trajectories. Another applied mathematics research deals with the development of general computer oriented algorithms, and progress is reported for a computer subroutine for linear algebraic problems. A celestial mechanics

program is concerned with the preparation of tables giving the position and velocity of each planet and the moon, as well as the nutations in longitude and latitude with their time derivatives as functions of ephemeris time. M.W.R.

N67-28678*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RECURSION FORMULAS FOR THE COEFFICIENTS OF THE f AND g SERIES
E. R. Lancaster and R. H. Estes Jun. 1967 6 p refs
(NASA-TM-X-55805; X-643-67-255) CFSTI: HC $3.00/MF $0.65 CSCL 12A

Two-body equations are presented for the case when the xy-plane coincides with the plane of motion and the positive x-axis is along the position vector $\bar{r}_0$ at time t_0. S.P.

N67-28683# Radio Corp. of America, Princeton, N. J.
RECOGNITION OF CLASS MEMBERSHIP BY MEANS OF WEAK, STATISTICALLY DEPENDENT FEATURES Final Report, May 1964–Mar. 1966
Ivan H. Sublette Wright-Patterson AFB, Ohio, AMRL, Dec. 1966 48 p refs
(Contract AF 33(615)-1764)
(AMRL-TR-66-174; AD-650492) CFSTI: HC $3.00/MF $0.65

A method of automatic classification is developed for the case in which the features used to determine the class of an unknown object x are individually weak. The features are weak in the sense that any subset of the universe defined by a single feature value of x contains many objects belonging to a class different from that of x. The classes are defined by a small collection of examples, which are objects whose class membership and feature values are known. The basic problem in classification by example is the estimation of probabilities from a small number of examples. Ideally, the class of x should be determined by estimating the class probabilities in the subset J defined by the conjunction of all of the feature values of x. But J usually will contain no examples on which to base an estimate of the class probabilities. The recognition procedure offered here employs a subset D defined by the conjunction of some, but not all, of the feature values of x. It is postulated that the features are statistically dependent in such a way that the particular kind of dependence exhibited by the features defining D can be used to infer the class of x. This recognition procedure includes a hypothesis-testing procedure in which the competing hypotheses are related to the dependence of the features defining D and are only indirectly related to the classes to which x could possibly belong. In this approach the class of x can be decided without requiring that D contain any examples. These principles are demonstrated by experiments in character recognition. TAB

N67-28695# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
METHOD OF POTENTIAL FUNCTIONS IN THE PROBLEM OF RECONSTRUCTION OF THE CHARACTERISTIC OF A FUNCTIONAL CONVERTER ACCORDING TO RANDOMLY OBSERVED POINTS
M. A. Ayzerman, E. M. Braverman, and L. I. Rozonoer 20 Feb. 1967 23 p refs Transl. into ENGLISH of the book "Metod Potentsial'nykh Funktsiy V Zadache O Vosstanovlenii Kharakteristiki Funktsional'nogo Preobrazovatelya Po Sluchayno Nablyudayemym Tochkam" Moscow, 1964 p 1–23
(FTD-MT-64-534; TT-67-61681; AD-651091) CFSTI: HC $3.00/MF $0.65

The method of potential functions is used to construct algorithms that allow approximate reconstruction of the characteristic of an unknown functional multi-input converter according to results of random observations of its work. The convergence of the algorithms is proven. In an example of the solution of a system of linear equations (i.e. the problem of matrix inversion), it is shown that the proposed algorithms can also be used to solve certain problems of computer mathematics. The problem of reconstructing the characteristic of a converter in the presence of interferences is also considered. Author (TAB)

N67-28700# RAND Corp., Santa Monica, Calif.
A FORMAL SYSTEM FOR THE LOGICAL ANALYSIS OF TEMPORAL RELATIONSHIPS BETWEEN INTERVALS OF TIME
Robert Mattison Apr. 1967 41 p refs
(Contract F44620-67-C-0045; Proj. RAND)
(RM-5279-PR; AD-651122) CFSTI: HC $3.00/MF $0.65

A formal deduction system is presented for the logical analysis of chronological data (such as before, after, and during relationships). The development of the system was motivated by the requirements of current data-retrieval projects, one of which is RAND's Cybernetics Data-Research Project. A mathematical model of intervals of time is constructed. Twenty basic configurations are used to express all possible time relationships, in which the smallest unit is one calendar day. Axioms are given for making inferences using the Tarski first-order predicate calculus with identity (=), one binary predicate constant (<), meaning wholly before, and two unary operations: min, meaning the beginning of, and max, the end of. Every sentence in this formal language is such that either it or its negation is deducible from the given axioms. Each proper expression is uniquely readable, semantic and syntactic completeness are demonstrated, the latter by mathematical logic using Kochen's theorems on ultra-products of models. An appendix gives more general axioms that have both the finite intervals of rationals and the finite intervals of reals as models. TAB

N67-28707 Royal Aircraft Establishment, Farnborough (England).
ON THE THEORY OF STABILITY OF CONTROL SYSTEMS [K TEORII USTOICHIVOSTI REGULIRUEMYKH SISTEM]
V. V. Rumyantsev Jan. 1967 17 p refs Transl. into ENGLISH from Prikl. Mat. i Mekh. (Moscow), v. 20, 1956 p 714–722
(RAE-LIB-TRANS-1210) CFSTI: HC $3.00

Conditions for the asymptotic stability of a linear system having several non-linear control devices are determined by constructing Lyapunov functions. The non-linear system of which the linear system is a first approximation is discussed briefly. Author

N67-28759*# Analytical Mechanics Associates, Inc., Uniondale, N. Y.
QUASILINEAR FORMULATION OF FINITE TRANSFORMATIONS
Henry Wolf Dec. 1964 11 p refs
(Contract NAS5-9085)
(NASA-CR-84821) CFSTI: HC $3.00/MF $0.65 CSCL 12A

A set of quasilinear formulas are developed for translating changes $\Delta\alpha$ into a set ΔR, ΔR which is related nonlinearly to α. The set of formulas is valid and numerically accurate for infinitesimal, as well as finite, $\Delta\alpha$. Author

N67-28763*# Analytical Mechanics Associates, Westbury, N. Y.
ESTIMATION OF STATE WITH ACCEPTABLE ACCURACY CONSTRAINTS Interim Report
Stanley F. Schmidt Jan. 1967 23 p refs
(Contract NAS5-9085)
(NASA-CR-84795; Rept.-67-4) CFSTI: HC $3.00/MF $0.65 CSCL 12A

A technique using the minimum variance estimator to eliminate problems associated with the determination of orbits, such as

that of a lunar orbiter from earth-based range and/or range rate tracking data, is discussed. The method is based on the philosophy that it is impossible to obtain a perfect estimate of the state vector, regardless of the number and quality of the observations. Instead, the observations are used in a near-optimal manner until the error in the estimate of the state is equal to some acceptable accuracy bound. Thereafter the observations are continually processed to keep the estimate within this acceptable accuracy bound. Author

N67-28767*# Grumman Aircraft Engineering Corp., Bethpage, N. Y.
STUDY ON DETERMINING STABILITY DOMAINS FOR NONLINEAR DYNAMICAL SYSTEMS Quarterly Progress Report, 1 May–1 Aug. 1966
G. Geiss 15 Aug. 1966 17 p refs
(Contract NAS8-20306)
(NASA-CR-84817; RM-334; QPR-1) CFSTI: HC $3.00/MF $0.65 CSCL 12A

The procedure for formulating the problem of estimating the domain of attraction of an equilibrium solution of a nonlinear dynamical system as two extremal problems is briefly described. The numerical algorithm used to solve these extremal problems is outlined, and the qualitative aspects of the computational results are described. Some remaining problems are described and the plans for future work are stated. Author

N67-28791*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
OPTIMUM PROCESSES IN SYSTEMS WITH DISTRIBUTED PARAMETERS AND SOME PROBLEMS OF INVARIANCE THEORY
A. I. Yegorov Redstone Arsenal, Ala., Redstone Sci. Inform. Center, Mar. 1967 91 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Ser. Mat. (Moscow), v. 29, no. 6, 1965 p 1205–1260 Jointly supported by Army Missile Command
(NASA-TM-X-59819; RSIC-649) CFSTI: HC $3.00/MF $0.65 CSCL 12A

Optimum processes in systems whose behavior is described by distinguishable boundary problems for partial differential equations are studied. Optimum control when processes are described by boundary conditions for hyperbolic and parabolic equations are investigated, and results are extended to elliptical systems. The connection of the problem with variational calculus is established, and it is shown that the Euler–Ostrogradskiy equations can be derived from the maximum principle if the control domain coincides with the entire space. Problems of the invariance theory are also discussed. N.E.N.

N67-28798*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
OPTIMAL COMPUTING FORMS FOR THE TWO-BODY C AND S SERIES
Christopher R. Herron, E. R. Lancaster, and W. R. Trebilcock May 1967 20 p refs
(NASA-TM-X-55799; X-643-67-239) CFSTI: HC $3.00/MF $0.65 CSCL 12A

Approximations are presented for the C and S functions and their derivative functions for application to the two-body problem. It is pointed out that these functions significantly reduce the computation times required for their evaluation when compared to that required by Taylor series expansions. The C and S functions are defined, and sixth degree polynomial approximations are constructed on various intervals in the sense of Chebyshev. The four approximation polynomials were generated for each of the intervals and converted to a specified form, and parameters for the Fike evaluation scheme were obtained. In each case, the values given by the final scheme were tested against the true values of the original function for all multiples of .002 in the interval concerned. Tables are presented that exhibit, for each of the sixteen functions considered, the coefficients for the form, the parameters for the Fike scheme, and the maximum absolute errors for both methods. L.E.W.

N67-28824*# Grumman Aircraft Engineering Corp., Bethpage, N. Y.
STUDY ON DETERMINING STABILITY DOMAINS FOR NONLINEAR DYNAMICAL SYSTEMS–II Quarterly Progress Report, 1 Aug.–31 Oct. 1966
J. V. Abbate, G. R. Geiss, and R. McGill 15 Nov. 1966 22 p refs
(Contract NAS8-20306)
(NASA-CR-84840; RM-348; QPR-2) CFSTI: HC $3.00/MF $0.65 CSCL 12A

Particular items discussed are: experimental results obtained via the algorithm developed during the previous quarter; reformulation of the algorithm to avoid computational difficulties encountered during the experiments; development of a parameterization of the set of positive definite n×n matrices; and analysis of a system with time dependent closed loop guidance. Plans for research during the last phase of the contract are outlined. Author

N67-28831*# Stanford Univ., Calif. Dept. of Aeronautics and Astronautics.
COMPUTATION OF OPTIMAL CONTROLS BY A METHOD BASED ON SECOND VARIATIONS
T. E. Bullock Dec. 1966 97 p refs
(Grant NsG-133-61)
(NASA-CR-84847; SUDAAR-297) CFSTI: HC $3.00/MF $0.65 CSCL 12A

This work is concerned with finding an efficient computational scheme for the solution to general optimal control problems with terminal constraints. It is initially assumed that the control variables are unbounded. The results are later extended to include a class of problems with bounded controls. The approach begins by showing how the control problem may be converted into a sequence of simpler control problems which admit analytic solutions. Optimal feedback control laws are obtained for them and tests show the optimality of the resulting controls. The final solution, in the form of a computational technique, is found by combining the method for generating a sequence of simplified control problems and their solution together with a method for automatically adjusting several parameters necessary to insure convergence. The resulting algorithm requires very little computational heuristics in actual machine calculations. Since the method is second order, convergence is considerably improved over the usual gradient techniques. Author

N67-28864# Toronto Univ. (Ontario). Dept. of Industrial Engineering.
AN INTEGRAL EQUATION APPROACH TO SECOND VARIATION TECHNIQUES FOR OPTIMAL CONTROL PROBLEMS
G. S. Tracz and B. Bernholtz [1967] 34 p refs Sponsored by Natl. Res. Council of Canada
CFSTI: HC $3.00/MF $0.65

This paper describes a new quadratic approximation procedure for the numerical solution of optimal control problems with terminal conditions. The procedure is iterative in nature. At each iteration,

a quadratic approximation to the change in an augmented objective function is maximized, subject to constraints imposed to ensure improved compliance with the terminal conditions. The solution to each of these subsidiary constrained maximization problems is obtained by solving simultaneously a linear matrix Fredholm integral equation and a system of linear algebraic equations for the variation $\delta u(t)$ in the control vector and for the variation $d\nu$ in the vector of Lagrange multipliers ν introduced to take the terminal conditions into account. Numerical examples are presented to illustrate the procedure. Relation to other optimization techniques and further areas of investigation are discussed. Author

N67-28876*# Purdue Univ., Lafayette, Ind. School of Electrical Engineering.
ON THE ANALYSIS AND SYNTHESIS OF CONTROL SYSTEMS USING A WORST CASE DISTURBANCE APPROACH
V. B. Haas and A. S. Morse Jun. 1967 61 p refs
(Grant NGR-15-005-021)
(NASA-CR-84838; TR-EE67-4) CSCL 12A

An error analysis problem is formulated, which is to determine the worst case (maximum) value of a system error index due to a bounded disturbance acting on a linear system. It is shown that this may be accomplished by computing the maximum value of a scalar function of known form with respect to a set of parameters which are restricted in magnitude. An efficient computational algorithm is developed which may be used in computing the maximum value of this function. The formulation of a worst case disturbance min–max problem is presented. The problem is to determine a controller which will result in the smallest worst case value of a system error index. The relationship between this min–max problem and the differential game is indicated. Min–max problems for general linear systems and three different types of performance indices are investigated. It is shown that the min–max solutions of two of these problems do not always exist. In the third problem investigated, which involves a bounded control and a bounded disturbance, the complete min–max solution is found. Author

N67-28889# Wisconsin Univ., Madison. Mathematics Research Center.
A NOTE ON THE NUMBER OF IDEMPOTENT ELEMENTS IN SYMMETRIC SEMIGROUPS
Bernard Harris Nov. 1966 9 p refs
(Contract DA-31-124-ARO(D)-462)
(MRC-699; AD-649089) CFSTI: HC $3.00/MF $0.65

An alternative derivation of the exponential generating function of the number of idempotent elements in symmetric semigroups is given. Author (TAB)

N67-28896# RAND Corp., Santa Monica, Calif.
TABULAR REPRESENTATIONS OF MULTIVARIATE FUNCTIONS—WITH APPLICATIONS TO TOPOGRAPHIC MODELING
B. W. Boehm Feb. 1967 76 p refs
(Contract F44620-67-C-0045; Proj. RAND)
(RM-4636-PR; AD-649330) CFSTI: HC $3.00/MF $0.65

An analysis of the computational space-time tradeoff for various tabular representations of multivariate functions, particularly topographic representation techniques, performance comparisons as related to terrain smoothness, terrain diversification, and accuracy of depiction are made of two contour methods, two uniform grid methods, and the RAND variable grid (microgrid) differential altitude method of tabular representation. The microgrid representation is found to be generally superior, but many problems have special properties which make other methods more efficient. The formulas given are upper bounds of time and cost for each method; they show whether or not it is necessary to analyze a problem for special structure to make it computationally tractable. Polynomial, statistical, and analog methods are discussed briefly. Graphic input devices, such as the RAND Tablet, facilitate preprocessing and reduce costs in elapsed time and dollars. Appendixes give an algorithm and convergence theorem for the contour tree representation, and describe the RAND microgrid. TAB

N67-28916# System Development Corp., Santa Monica, Calif.
A GENERALIZATION OF CONTEXT FREE DETERMINISM
Scientific Report
Thomas N. Hibbard 21 Nov. 1966 71 p refs
(Contract F19628-67-C-0008; Grant AF-AFOSR-1203-67)
(TM-738/028/00; AFCRL-67-0077; SR-2; AD-651063) CFSTI: HC $3.00/MF $0.65

Nondeterministic Turing machines, under the restriction that each square be written on only a fixed number of times, recognize all and only context free languages. The deterministic subclass gives rise to a hierarchical extension of the pushdown deterministic languages. Unambiguity in terms of the machines is the same as grammatical unambiguity. Author (TAB)

N67-28975# Northwestern Univ., Evanston, Ill. Technological Inst.
SECOND ORDER SUFFICIENT CONDITIONS FOR WEAK AND STRICT CONSTRAINED MINIMA
Anthony V. Fiacco Apr. 1967 10 p refs *Its* Systems Res. Memo. no. 175
(Contracts Nonr-1228(10); DA-31-124-ARO(D)-322)
(AD-650285) CFSTI: HC $3.00/MF $0.65

Recently, for x epsilon E to the the nth power, McCormick proved a theorem giving sufficient second order (i.e., depending on twice differentiability) conditions for a strict local minimum of a function constrained by equality and inequality constraints. A different development and proof can be found in the book by Hestenes. In Theorem 1 following, second order conditions are given for a weak local constrained minimum. The proof closely parallels the proof given by McCormick in, the essential modification of the conditions and proof involving regulatory assumptions on the behavior of the Hessian of the associated Lagrangian function of the problem, in a suitable feasible neighborhood of the minimizing point. The proof of this result, slightly modified, leads to Theorem 2 which provides a neighborhood characterization for a strict local constrained minimum. Several corollaries follow. Corollary 1 being the above-indicated theorem proved by McCormick and Hestenes. Author (TAB)

20 METEOROLOGY

Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

N67-27858# Academy of Sciences (USSR), Moscow. Soviet Geophysical Committee.
METEOROLOGICAL RESEARCHES, NO. 11
1966 177 p refs In RUSSIAN; ENGLISH summaries
(Rept.-11) CFSTI: HC $3.00/MF $0.65

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2. ON THE ATMOSPHERIC CIRCULATION OVER THE ANTARCTIC L. A. Zhdanov p 43–125 refs (See N67-27858 15-20)

3. CHARACTERISTIC FEATURES OF THE ATMOSPHERE IN THE NORTHERN AND SOUTHERN HEMISPHERES DURING GREAT PRESSURE ANOMALIES IN THE NORTHERN HEMISPHERE IN 1955–1969 D. I. Stekhnovsky p 126–157 refs (See N67-27859 15-20)

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N67-27857# Academy of Sciences (USSR), Moscow. Soviet Geophysical Committee.

TYPES OF THE ATMOSPHERIC PROCESSES AND ASSOCIATED WIND FIELDS OVER THE OCEANIC AREAS OF THE SOUTHERN HEMISPHERE

N. G. Davydova *In its* Meteor. Res., No. 11 1966 p 5–42 refs In RUSSIAN; ENGLISH summary (See N67-27856 15-20)

On the ground of the generalization of the synoptic data for the period of the IGY (1956–1958), all the varieties of the atmospheric processes of the oceanic areas of the Southern Hemisphere are brought to 5–7 types for every ocean separately. All the revealed types of processes and corresponding to them wind fields are discussed in accordance with the task of calculation of the regime of wind waves. The types of processes are classified into meridional and zonal. It is stated that the meridional processes prevail in all the tree oceans of the Southern Hemisphere during the year but are more pronounced in the Atlantic Ocean. Frequency, succession and duration of the action of the revealed types of the atmospheric processes are given. Author

N67-27858# Academy of Sciences (USSR), Moscow. Soviet Geophysical Committee.

ON THE ATMOSPHERIC CIRCULATION OVER THE ANTARCTIC

L. A. Zhdanov *In its* Meteor. Res., No. 11 1966 p 43–125 refs In RUSSIAN; ENGLISH summary (See N67-27856 15-20)

A short aerometeorological characteristic of the area of Mirny and features of the atmospheric circulation in the troposphere and lower stratosphere over the Antarctic in 1962 is given. Atmospheric circulation in 1962 is compared with the circulations in other years. Areas of the formation of the Antarctic anticyclones are indicated and medians of cyclonic and anticyclonic trajectories are drawn as well as the velocities of the movement of cyclones and anticyclones are shown. Migration of trajectories in the main ring of subtropical anticyclones is considered. On the basis of the biannual cycles revealed in the free atmosphere during the years with zonal and meridional circulations the distribution of the annual temperature variation is shown for the eastern part of the Eastern Antarctic and the coast of the eastern part of Weddell Sea. In the Appendix charts of pressure, tropopause, cyclonic and anticyclonic trajectories for 1962 are presented. Author

N67-27859# Academy of Sciences (USSR), Moscow. Soviet Geophysical Committee.

CHARACTERISTIC FEATURES OF THE ATMOSPHERE IN THE NORTHERN AND SOUTHERN HEMISPHERES DURING GREAT PRESSURE ANOMALIES IN THE NORTHERN HEMISPHERE IN 1955–1959

D. I. Stekhnovsky *In its* Meteor. Res., No. 11 1966 p 126–157 refs In RUSSIAN; ENGLISH summary (See N67-27856 15-20)

Characteristic features of the development of atmospheric processes over the Southern and Northern Hemispheres (meridional and zonal indices of circulation, frequency of the types of circulation, etc) in 1955–1959 are described. Relationship between the atmospheric circulations of the Northern and Southern Hemispheres during the great pressure anomalies in the Northern Hemisphere is discussed. Relationships between the formation of stable anomalies of the air mass and the intensity of zonal circulation are determined. Author

N67-27953# White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.

REAL-TIME METEOROLOGICAL SYSTEM FOR SUPPORT OF UNGUIDED-ROCKET FIRINGS

Louis D. Duncan *In* Army Dept. Proc. of the 1966 Army Sci. Conf., Vol. I 26 Aug. 1966 p 211–216 ref (See N67-27941 15-34)
(AD-634672)

Prelaunch impact prediction for unguided, high altitude, multiple-stage rockets is provided by a real-time meteorological system that has been used primarily in connection with Agena rocket firings. The real-time system which has the advantage of economy over an individual guidance system for each rocket firing, operates for approximately two hours plus hold time for a typical firing. During this operational period, 2 hours of tower time are received and analyzed, 10 to 15 pilot balloon tracks are analyzed, and launcher settings are computed between 10 and 15 times. M.W.R.

N67-28133 Joint Publications Research Service, Washington, D. C.

METEOROLOGY AND HYDROLOGY, NO. 11, 1966

21 Feb. 1967 115 p refs Transl. into ENGLISH from the publ. "Meteorologiya i Gidrologiya" (Moscow), no. 11, Nov. 1966 p 3–14, 15–25, 26–33, 34–39, 39–45, 53–57
(JPRS-39987; TT-67-30634)

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3. SOME DATA ON TURBULENCE IN THE UPPER TROPOSPHERE AND STRATOSPHERE CAUSING AIRPLANE BUFFETING N. K. Vinnichenko, N. Z. Pinus, and G. N. Shur p 35–47 refs (See N67-28136 15-20)

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N67-28134 Joint Publications Research Service, Washington, D. C.

ON A RATIONAL SYSTEM FOR OBTAINING HYDROMETEOROLOGICAL INFORMATION

Ye. K. Fedorov *In its* Meteorol. and Hydrol., No. 11, 1966 21 Feb. 1967 p 1–17 (See N67-28133 15-20)

Several ideas are presented for consideration in organizing a system for obtaining, processing and analyzing atmospheric and hydrospheric information. The present system is assessed, and its shortcomings are discussed in relation to the needs of obtaining primary data for application to various sectors of the national economy. It is pointed out that long-range development planning in various branches of the economy require certain general data about the future regimes of specific meteorological and hydrological elements. The critical level of the accuracy and timeliness of the long range forecasts is also considered. Methods of accelerating the solution of scientific–technical problems are proposed. M.G.J.

N67-28135 Joint Publications Research Service, Washington, D. C.

IN DETERMINING THE TURBULENT EXCHANGE OF HEAT BETWEEN OCEAN AND ATMOSPHERE

M. I. Budyko and L. S. Gandin *In its* Meteorol. and Hydrol., No. 11, 1966 21 Feb. 1967 p 18–34 refs (See N67-28133 15-20)

Various formulas used to obtain the mean values of the turbulent fluxes of heat and moisture over the ocean are critically assessed. These include (1) a hypothesis which can be considered reasonable for conditions of temperature stratification close to equilibrium; (2) the errors which arise when consideration is not given to the fact that mean values of the fluxes over land are determined primarily by their daytime values; (3) overexaggerating the influence of thermal stratification, and underestimating wind velocity effects on the values of the fluxes; and (4) the relationship between the intensity of turbulent exchanges and Richardson's number. Also discussed is the feasibility of using certain equations for determining the monthly totals of the corresponding fluxes based on the mean monthly values of the meteorological elements. M.G.J.

N67-28136 Joint Publications Research Service, Washington, D. C.

SOME DATA ON TURBULENCE IN THE UPPER TROPOSPHERE AND STRATOSPHERE CAUSING AIRPLANE BUFFETING

N. K. Vinnichenko, N. Z. Pinus, and G. N. Shur *In its* Meteorol. and Hydrol., No. 11, 1966 21 Feb. 1967 p 35–47 refs Presented at the Sci. Conf. on the Forecasting of Wind, Temp. and Turbulence for Jet Airplanes, Moscow, 10–13 Nov. 1965 (See N67-28133 15-20)

An overview is presented on clear air turbulence (CAT) investigations using aircraft, radar, radiosondes, and lidars. These data indicate the frequency of turbulence as a function of altitude; the annual pattern of turbulence frequency over Moscow; the integral frequency of the thickness and the horizontal length of the turbulent layers; and the frequency of aircraft buffeting. The difficulties involved in developing a theory of CAT in the troposphere and stratosphere are discussed in relation to the need of concurrently developing airborne equipment to warn pilots of approaching turbulent zones. It is assumed that the influence of buoyancy in the stratosphere should be the same as in the troposphere, and that the turbulence spectra in the stratosphere will have a slope greater than minus 5/3 and will not differ significantly from the spectra obtained for lower altitudes. M.G.J.

N67-28137 Joint Publications Research Service, Washington, D. C.

THE VELOPAUSE AND ITS TOPOGRAPHIC PECULIARITIES OVER USSR TERRITORY

I. V. Bugayeva *In its* Meteorol. and Hydrol., No. 11, 1966 21 Feb. 1967 p 48–56 ref (See N67-28133 15-20)

The problem of determining the lower boundary of the summer anticyclonic circulation in the stratosphere is discussed. The transitional layer (velopause), in which unstable gentle breeze and calm are observed, separates the stratospheric anticyclonic circulation from the lower cyclonic circumpolar circulation. The level from which the easterly regime in the stratosphere begins is considered as the height of the velopause. To determine the mean height, observations from 57 Soviet radiosonde stations were used, and topographic charts were constructed. Peculiarities in the seasonal trends are noted. An analysis of how the height of the velopause and the peculiarities of its daily topography react to synoptic changes in the lower layers of the atmosphere shows that in most cases there is no reaction. A correlation between the geographic latitude and the velopause height was also established. It was found that for the entire Soviet Union the correlation coefficient equaled approximately 0.81. M.G.J.

N67-28138 Joint Publications Research Service, Washington, D. C.

ON THE ROLE OF THE VERTICAL MOTIONS IN TEMPERATURE CHANGES DURING STRATOSPHERIC WARMING

M. V. Shabel'nikova *In its* Meteorol. and Hydrol., No. 11, 1966 21 Feb. 1967 p 57–66 refs (See N67-28133 15-20)

Data are presented in rebuttal to the assumption that the processes in the stratosphere develop independently and are not related to the processes taking place in the troposphere. A heat flux equation is formulated to show that at an identical velocity of vertical motion the changes in air temperature will be the greater, the more stable its stratification. A detailed analysis is presented on the stratospheric warming that took place in January 1963. Based on these data, it is concluded that stratospheric warming in winter is the result of tropospheric developments, with the basic role played by vertical motions of air. These are due to the spreading of meridional changes from the troposphere to the stratosphere. M.G.J.

N67-28139 Joint Publications Research Service, Washington, D. C.

PRELIMINARY RESULTS OF PRECIPITATION-GAGE COMPARISONS

L. R. Struzer, V. S. Golubev, and I. G. Gorbunova *In its* Meteorol. and Hydrol., No. 11, 1966 21 Feb. 1967 p 70–80 refs (See N67-28133 15-20)

Comparative data are presented on standard domestic precipitation gauges and the temporary international reference precipitation gauge (IRPG). Details are also given on the methods used in the Soviet Union to determine the relationship between the differences in the instrument readings and the physical factors that cause systematic errors in the readings. A technique for converting to a uniform international scale the precipitation norms obtained with various gauges is proposed. M.G.J.

N67-28272# White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.
DETERMINATION OF A REPRESENTATIVE WIND PROFILE FROM BALLOON DATA
Manuel Armendariz and Henry Rachele Dec. 1966 30 p refs
(ECOM-5099; AD-649131) CFSTI: HC $3.00/MF $0.65

Wind profiles derived from tracking 100-gram balloons and jimspheres were subjected to power spectral analysis to determine the frequencies corresponding to instrumental noise, self-induced balloon oscillations, and the wind profile. In this analysis, a smoothing technique using a truncated Fourier series effectively filtered out the unwanted portion of the spectrum without attenuating the desired portion. Sample wind profiles showing the effect of using a 17-point binomial smoothing as well as truncated Fourier smoothing are presented. Author (TAB)

N67-28385# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE PRESENT STATE OF RADIOMETEOROLOGY
Lee Chi'seng 20 Dec. 1966 27 p refs Transl. into ENGLISH from K'o Hsueh T'ung Pao (Peking), no. 6, 1964 p 501–509
(FTD-HT-66-40; TT-67-61333; AD-649034) CFSTI: HC $3.00/MF $0.65

The state of the art of radiometeorology is briefly discussed. The topics introduced include the propagations of ultra high frequency wave in the fluid flow medium and in the cross flow current of a non-homogeneous medium, the effects of water vapor containing substances in space on the ultrahigh frequency wave and the antenna design used for radar for meteorological uses. Clear understanding of these phenomenon and design effects the applications of ultra high frequency waves in travel, communication, etc. The author visualizes better understanding of meteorology as a result of application of radio method in meteorological study. Author (TAB)

N67-28388# Allied Research Associates, Inc., Concord, Mass. Geophysics Div.
APPLICATION OF DOPPLER RADAR TO STORM DYNAMICS Final Report, Dec. 1963–Dec. 1966
Raymond Wexler Jan. 1967 77 p refs
(Contract AF 19(628)-3893)
(AFCRL-67-0100; Rept.-962-F; AD-649317) CFSTI: HC $3.00/MF $0.65

The variance due to vertical wind shear is calculated for Doppler wind measurements using a realistic beam pattern. The effect of reflectivity changing with height is evaluated. The existence of horizontal wind shear is analyzed from measurements by Doppler radar in widespread precipitation. The method of determining wind velocity, divergence and deformation is summarized. By representing the distribution of precipitation fall speeds with a Gaussian function, rain intensity and liquid water content are determined as a function of the reflectivity, the mean fall velocity and the standard deviation. A case of sorting of a Marshall-Palmer drop size distribution is analyzed. Multigate Doppler observations in snow demonstrate the feasibility of measuring the translation, dimension and amplitude of microscale turbulence. Eddies at low levels have periods of about one minute and dimensions of 0.4 km. These increase at higher levels. Author (TAB)

N67-28391# Air Weather Service, Scott AFB, Ill.
WIND SHEAR AND TURBULENCE OVER SELECTED STATIONS OF THE AIR FORCE WESTERN TEST RANGE
Lloyd V. Mitchell Dec. 1966 31 p refs
(AWS-TR-189; AD-649345) CFSTI: HC $3.00/MF $0.65

The report presents wind-shear data for three areas of the Air Force Western Test Range (AFWTR) and turbulence data, which are applicable to AFWTR, for portions of the Northern Hemisphere. A method is described and used for estimating the means and standard deviations of wind shears for smaller layers using wind-shear data measured through thicker layers. Estimates of turbulence frequency and intensity are presented based upon the relationship between wind shear and turbulence. Mean wind shear and wind shear variability maxima occur at approximately 40,000, 55,000, 130,000, and 220,000 feet with minima at 100,000 and 150,000 feet. Turbulence frequency and intensity maxima occur near 30,000, 130,000, and 220,000 feet with minima near 45,000, 120,000, and 150,000 feet. Author (TAB)

21 NAVIGATION

Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

N67-27870 Royal Aircraft Establishment, Farnborough (England).
GUIDANCE AND CONTROL OF AIRCRAFT GROUND MOVEMENT AT AIRPORTS DURING RESTRICTED VISIBILITY: A SURVEY OF REQUIREMENTS AND POSSIBLE SYSTEMS
A. F. Hammond Mar. 1965 28 p refs
(RAE-TR-65071)

The problems involved in maintaining ground movement in low visibility, posed by the introduction of automatic landing, are reviewed, and the provision of a nonvisual guidance and control system is considered. The facilities and performance required to be provided by such a system are formulated and possible techniques which might be employed are discussed. From this it is proposed that a system based on magnetic leader cables and loops be selected for an experimental feasibility study. Author

N67-28131 Royal Aircraft Establishment, Farnborough (England).
A FLIGHT EXPERIMENT TO DETERMINE THE EFFECTS OF FLARE ENTRY CONDITIONS ON AUTOMATIC LANDING PERFORMANCE
N. H. Hughes and G. P. Lazenby Dec. 1965 20 p ref
(RAE-TR-65283)

A flight experiment is described which was designed to confirm the results of an analog computer study of the effect of initial conditions at the entry to the flare-out on the touchdown performance of an automatic landing system. The flight results generally justify the conclusions from the computer study but differences appear at high initial rates of descent. The reason for the differences may be nonlinearity in the actual autopilot hardware due to limiting of the commanded pitch rate. Author

N67-28512# Litton Systems, Inc., Woodland Hills, Calif. Guidance and Control Systems Div.
EVALUATION OF INERTIAL NAVIGATION SYSTEM IN CIVIL AIR TRANSPORT OPERATIONS. VOLUME I: LM-12 INERTIAL NAVIGATION SYSTEM. BOOK I: DISCUSSION AND ANALYSIS Final Report
Robert J. Holm 15 Jun. 1966 173 p refs
(Contract FA-65-WA-1112)
(SRDS-RD-66-30-1; AQ22016E66; AD-649127) CFSTI: HC $3.00/MF $0.65

A Litton LN-12 inertial navigation system, with a Bendix Corporation inertial navigation steering computer, was flown in a Pan American World Airways DC-8 aircraft for 55 scheduled transatlantic crossings and 32 other short flights, domestic and foreign. Performance data were collected on inertial accuracy, steering behavior, track holding, maintenance, reliability, in-flight operation, position checks and azimuth drift. Eighty percent of the flights exhibited terminal errors of 10 miles or less in either latitude or longitude coordinates. The LN-12 inertial system operated 424 hours in the navigation mode, during 233 hours of which the aircraft was guided by autopilot controlled by inertial steering commands. Two transatlantic flights are examined in detail for doppler comparison in cross track miles to go, ground speed, and drift angle. These flights are also analyzed for comparison with aircraft compass heading, measured track, drift angle, miles to go, track heading, and waypoint misses. Reliability and maintenance factors were not significant during conduct of the program. Prior to commencement of the data flights, two demonstration flights of dual LN-12 inertial systems were performed. Author (TAB)

N67-28516# California Univ., Berkeley. Inst. of Transportation and Traffic Engineering.
EFFECT OF BACKSCATTER FROM AIRCRAFT BEACON LIGHTS ON TARGET VISIBILITY IN FOG Final Report
D. M. Finch, E. C. Curwen, and L. E. King Nov. 1966 42 p refs
(Contract FAA-ARDS-434)
(SRDS-RD-66-57; AD-648611) CFSTI: HC $3.00/MF $0.65

Tests were performed in the fog chamber to determine how the backscatter from aircraft beacon lights (collision-avoidance lights) in a fog of 0.21 per mile transmittance affects an observer's ability to see a set of target lights at a fixed distance equal to the corresponding visual range of 3 miles (approximately 16,000 ft). The tests investigated three white and three red beacon lights, both steady-burning and flashing, with peak intensities from 1200 to 200,000 cp in white and 1200 to 25,000 cp in red. Results from a total of over 10,000 observations, made by 34 observers, show that the use of the beacon lights produced no appreciable reduction in target-light visibility except with the highest white-light intensity. There was no apparent difference between the steady-burning and flashing modes of the beacons insofar as target visibility is concerned. Author (TAB)

N67-28649*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
GUIDANCE SYSTEMS
In its Res. and Advanced Develop., Vol. II 31 Jan. 1967 p 185–226 refs (See N67-28641 15-34)

A strapdown electrostatically suspended gyro (ESG) is being developed as an inertial, two-axis, angular reference sensor for spacecraft and capsule attitude control. Emphasis is on improvement of the high voltage rotor suspension system to increase its temperature range, to overcome bad effects of electrical charge accumulation, and to widen the frequency response to mechanical disturbances. New attitude reference sensors, other than ESGs, are being evaluated. Status of the Strapdown Electrostatic Gyro Aerospace Navigation system to determine the feasibility of an inertial navigation system is reported. Other research efforts deal with approach guidance subsystem development, magnetic logic computer development, guidance computer organization, guidance for future missions, and maneuver strategy and navigation analysis. M.W.R.

N67-28743*# Philco Corp., Palo Alto, Calif. WDL Div.
INTERPLANETARY NAVIGATION AND GUIDANCE STUDY. VOLUME III: ILLUSTRATIONS AND TABLES
28 Mar. 1966 99 p refs
(Contract NAS8-11198)
(NASA-CR-61131) CSCL 17G

Presented are figures and tables pertaining to Volume II of the report. Included are representations of: (1) coordinates and trajectories; (2) error determinations; (3) planetary orientation data; (4) guidance and tracking data; (5) distance and range measurements; (6) navigation and guidance systems performance; (7) injection and orbital calculations; and (8) system and tracking schedules. K.W.

N67-28839*# California Inst. of Tech., Pasadena.
ACCURATE GUIDANCE WITH LARGE OPTICAL EQUIPMENT
Bruce H. Rule [1967] 19 p
(NASA-CR-84834; SSS-67-78) CFSTI: HC $3.00/MF $0.65 CSCL 17G

Presented herein is a review of the advance of telescope accuracy technique and a discussion of the criteria of excellence for large ground-based optical telescopes. The criteria of excellence discussed are based on those required for the largest, most well known ground-based telescope, the 200-in. (508-cm) Hale telescope at Mt. Wilson and Palomar Observatories. The main factors of these criteria could apply equally well to the criteria for space telescopes. Author

N67-28860 Technisch Documentatie en Informatie Centrum Voor de Krijgsmacht, The Hague (Netherlands).
INERTIAL NAVIGATION—REPORT ON THE RECENT DEVELOPMENTS OF INERTIAL TECHNIQUES, SYSTEMS AND EQUIPMENT, FOR SEA AND AIR APPLICATIONS, 1962–1967
H. J. Bos Jan. 1967 35 p refs
(TDCK-46515)

A review is presented on the development history during the period 1962–1967 of present-day requirements for sea and air applications, the availability, and the future aspects. The consulted literature is referenced chronologically with 137 items. A basic system description and the method of operation are included, as well as a four-language glossary of technical terms. Author

N67-28917# George Washington Univ., Washington, D. C. Human Resources Research Office.
SOME COMMENTS ON THE DISPLAY OF CARTOGRAPHIC INFORMATION FOR VERY LOW LEVEL FLIGHT
Robert H. Wright Mar. 1967 10 p Presented at the Symp. on Aeron. Charts and Map Displays, Washington, D. C., Nov. 1966 *Its* Profess. Paper 13–67
(Contract DA-44-188-ARO-2)
(AD-650445) CFSTI: HC $3.00/MF $0.65

A summary is given of the characteristics of the information available for geographic orientation during very low level flight, and some characteristics of cartographic displays that would enable the pilot to use this information more effectively in navigating at low level. TAB

22 NUCLEAR ENGINEERING

Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

N67-27782# United Kingdom Atomic Energy Authority, Harwell (England). Research Reactors Div.

THERMO-FLUX VARIATIONS IN THE PLUTO TYPE RESEARCH REACTORS DUE TO CONTROL-ABSORBER MOVEMENT

I. S. McGill and M. J. Crook Nov. 1966 21 p
(AERE-M-1819) CFSTI: HC $3.00/MF $0.65

The thermal flux variations occurring in the Pluto type research reactors due to control-absorber movement are illustrated by measurements obtained in the Daphne zero-energy mock-up. Control by both the original semaphore-arm type coarse-control absorbers and vertical control rods is considered. Author

N67-27784# United Kingdom Atomic Energy Authority, Harwell (England). Research Reactors Div.

SOME FLUX MEASUREMENTS IN MOCK-UP POWER CYCLING RIGS (PLUTO 7V TYPE)

I. S. McGill and M. J. Crook Nov. 1966 10 p ref
(AERE-M-1820) CFSTI: HC $3.00/MF $0.65

Some general features of Pluto 7V type power-cycling rigs are illustrated by thermal-flux measurements in two simulated rigs in the 7V4 position of the Daphne Pluto mock-up. The results quoted justify the rule of thumb that a neutron shutter should overlap the test section by at least one diameter and should be withdrawn at least one diameter beyond the top of the test section. Author

N67-27854 Aktiebolaget Atomenergi, Stockholm (Sweden).

BURN-UP DETERMINATION BY HIGH RESOLUTION GAMMA SPECTROMETRY: FISSION PRODUCT MIGRATION STUDIES

R. S. Forsyth, W. H. Blackadder, and N. Ronqvist Apr. 1967 24 p refs
(AE-272)

As part of an experimental program to develop burn-up methods, gamma scanning experiments have been performed on slices of irradiated UO_2 pellets using a lithium-drifted germanium detector. The usefulness of the technique for migration studies has been demonstrated by comparing the fission product distribution curves across the specimen diameters with the microstructure of the specimens after polishing and etching. Author

N67-27861 United Kingdom Atomic Energy Authority, Harwell (England). Research Group.

BEAM INTENSITY MEASUREMENTS ON THE DIDO COLD NEUTRON APPARATUS

S. J. Cocking and F. J. Webb Jan. 1967 23 p refs
(AERE-R-5168) HMSO: 3s 6d

The inpile section of the liquid hydrogen loop in DIDO was replaced during 1965. This report gives the results of beam measurements over a range of neutron wavelengths made on the earlier loop and its replacement. The flux gain obtained with use of the liquid hydrogen moderator was 6 for 4.2Å neutrons increasing to 11 for 8Å neutrons. Despite modification to the shape and volume of the moderator chamber these gain figures differ little between the two loops. Attempts were made to fit the observed spectra and gain factors using both single and two component Maxwellian spectra. Measurements of the gain in flux by liquid nitrogen cooling the polycrystalline beryllium beam filters are also reported. The observed flux gain factor for 4.1Å neutrons on cooling was 3.9, 20% lower than was calculated from published cross section data. The overall fluxes with the new equipment are higher than those obtained earlier; the improvement ranges from 50% at 4.1Å to more than 100% at longer wavelengths. Author

N67-27865 Institutt for Atomenergi, Kjeller (Norway).

NEUTRON COUNTING STATISTICS IN NUCLEAR REACTORS

Dusan Babala Nov. 1966 98 p refs
(KR-114)

The neutron counting statistics of a zero power reactor is treated on the basis of Kolmogorov's theory of branching processes. It is shown that the statistical properties of a sequence of neutron counts, used for experimental determination of reactor kinetic parameters, naturally follow from one basic formula. The Kolmogorov formalism also made it possible to explain the results of Rossi-α experiments performed with a certain type of time analyzers. Further, a formula for the count interval distribution has been derived and a new experimental method—interval distribution measurement—suggested. The technique has been employed for determining the prompt decay constants of the NORA reactor and compared with other experimental methods. The effects of space and energy dependence are numerically illustrated for a reference slab reactor. Both multiregion technique and modal analysis were used for computations. It is shown that the fundamental mode can be interpreted in terms of space and energy independent model, if the neutron lifetime is suitably defined. Author

N67-27902# Naval Radiological Defense Lab., San Francisco, Calif.

RADIOCHEMICAL AND PHYSICOCHEMICAL STUDIES OF KIWI-TNT DEBRIS

John R. Lai, Joseph D. O'Conner, Glenn R. Crocker, Juan N. Pascual, and Edward C. Freiling 28 Sep. 1966 138 p refs
(Contract AT(49-5)-2505)
(USNRDL-TR-1100) CFSTI: HC $3.00/MF $0.65

Five samples of debris from the Kiwi-TNT event were studied for properties relating to biological hazard: particle properties, radiation properties, radiochemical composition and radionuclide solubility. Gross gamma decay rates exhibited negative logarithmic exponents ranging from 0.73 to 1.76. The gamma-ray spectra of the three cloud samples were similar, but otherwise significant differences were found from sample to sample. Radiochemical analysis showed that the ground-filter sample was highly enriched in volatilely behaving fission products ($^{89,90}Sr$, ^{131}I, ^{132}Te, ^{137}Cs). The cloud samples were somewhat enriched in volatiles, but relatively representative. The fallout sample showed a depletion of volatiles. This depletion increased as the particle size diminished and as the particle shape became more spheroidal. The fractionation behavior was quite similar to that observed in weapon debris, as was the dependence of fractionation on particle shape. The dependence of fractionation on particle size in the fallout sample, however, was the opposite of that observed in weapon debris and indicates the operation of different fractionation mechanisms. Distilled water, 0.8% saline and 0.1*N* HCl were tested for their ability to leach activity from the debris. NSA

N67-27907# Los Alamos Scientific Lab., N. Mex.

APPLICATION OF INDUSTRIAL SAFETY PRACTICES TO NUCLEAR SAFETY

Roy Reider [1967] 15 p refs Presented at Am. Nucl. Soc. Natl. Topical Meeting, Nucl. Criticality Safety, Las Vegas, Nev.
(Contract W-7405-ENG-36)
(LA-DC-8395; CONF-661206-4) CFSTI: HC $3.00/MF $0.65

Application of industrial safety practices in handling stored coal and low or deflagrating explosives are compared to the problems involved in handling critical masses safely in nuclear energy. The problems of safety motivation are also discussed. The motivation for safety may be either directed or self-induced. NSA

N67-27915# Du Pont De Nemours (E. I.) and Co., Aiken, S. C. Savannah River Lab.
SAVANNA RIVER LABORATORY ISOTOPIC POWER AND HEAT SOURCES Quarterly Progress Report, Oct.–Dec. 1966
H. S. Hilborn, comp. Jan. 1967 29 p refs
(Contract AT(07-2)-1)
(DP-1094) CFSTI: HC $3.00/MF $0.65

A program to develop, fabricate, and test capsules containing (1) ^{60}Co in an oxidation resistant cladding and (2) a higher temperature form of ^{60}Co in a refractory metal cladding was undertaken to meet the needs of heat source designers and users. Of the capsule materials tested, "Inconel" 600 and TD Nickel are most compatible with cobalt metal. TD Nickel Chromium had outstanding oxidation resistance. Cobalt-60 heat sources were shown to require lighter shields than $^{90}SrTiO_3$ heat sources at powers above 2 kW(t). A second program dealing with the development of technology needed for large-scale manufacture of ^{244}Cm fuel capsules is described. The monoclinic B-type Cm_2O_3 appeared to be the best curium oxide for heat sources. A cermet compact of Cm_2O_3 with tungsten, fabricated by cold pressing and sintering at 1850°C, showed no deleterious interaction between the oxide and metal particles. A shipping container for transporting curium oxide in 120 g batches was designed. NSA

N67-27917# Battelle Memorial Inst., Columbus, Ohio.
INVESTIGATION OF THE INITIATION AND EXTENT OF DUCTILE PIPE RUPTURE Progress Report, May–Dec. 1966
Robert J. Eiber, Glen M. Hein, Arthur R. Duffy, and T. J. Atterbury Jan. 1967 26 p refs
(Contract W-7405-ENG-92)
(BMI-1793) CFSTI: HC $3.00/MF $0.65

Developments in studies to determine what size defects in typical reactor-coolant piping are required to produce unstable propagating fractures under boiling-water and pressurized-water reactor conditions are reported. Theoretical formulations for predicting the failure stresses of through-the-wall and surface defects as a function of a critical-stress-intensity factor are presented. These formulations were found to provide accurate predictions of failure stresses in relatively thin-wall Al and steel pressure vessels containing defects. The experimental programs for full scale and laboratory tests are described. NSA

N67-27919# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.
GAS DETECTORS FOR THERMAL NEUTRON AT HIGH COUNTING RATES [ETUDE DES DETECTEURS A GAZ POUR NEUTRONS THERMIQUES FONCTIONNANT EN COLLECTION DE COURANT]
Vuong Quan Mai (Ph.D. Thesis—Grenoble Univ.) 1966 133 p refs In FRENCH
(CEA-R-2962) CFSTI: HC $3.00/MF $0.65

After a discussion of the current pulse formation theory in a cylindrical shape counter with and without gas multiplication, the schemes of pulse amplifier and level discriminator which have allowed verification of the above calculations and clarification of the part at high counting rates of the space charge in proportional counters are discussed. The theory of that phenomenon is given. The results obtained in a nuclear reactor with a counting-channel built with the above electronic circuits are also presented. Author (NSA)

N67-27973# Nuclear Power Field Office, Fort Belvoir, Va.
GAMMA-INDUCED SENSITIVITY LOSS IN THE PROPORTIONAL COUNTERS OF A NUCLEAR POWER PLANT
James K. McNally *In* Army Dept. Proc. of the 1966 Army Sci. Conf., Vol. II 26 Aug. 1966 p 61–75 refs (See N67-27971 15-34)
(AD-634621)

Magnitude and duration of sensitivity loss in solid state proportional neutron counters of nuclear plants following power shutdown was found dependent on the duration of full power operation. Gamma irradiation tests on B^{10} lined and BF_3 filled proportional counters showed that their sensitivity depended strongly upon operating gamma flux intensity; loss of sensitivity occurred because of pulse height reduction at increased gamma flux. Upper and lower ends of the voltage plateau shifted to higher voltages as the gamma flux increased. G.G.

N67-28173 Joint Publications Research Service, Washington, D. C.
SODIUM-COOLED NUCLEAR REACTORS
24 Feb. 1967 97 p refs Transl. into ENGLISH from "Simpozium po Shchelochnym Metallicheskim Teplonositelyam: Izucheniye Problem Korrozii i Opyt Ekspluatatsii Sistem" Vienna, Intern. Atomic Energy Agency, 1966 Symp. held in Vienna, 28 Nov.–2 Dec. 1966
(JPRS-40027; TT-67-30674) CFSTI: $3.00

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2. BEHAVIOR OF STAINLESS STEELS IN SODIUM IN THE 600–900° TEMPERATURE RANGE N. P. Agapova, A. G. Ioltukhovskiy, and V. V. Romanayev p 18–30 (See N67-28175 15-17)

3. PRECIPITATION OF OXIDES FROM A SODIUM FLOW V. I. Subbotin and F. A. Kozlov p 31–53 refs (See N67-28176 15-06)

4. STUDY OF SODIUM PURIFICATION OF HIGH-EFFICIENCY COLD DIFFUSION TRAPS M. N. Arnol'dov, M. N. Ivanovskiy, V. I. Subbotin, and B. A. Shmatko p 54–67 refs (See N67-28177 15-22)

5. STUDY OF IMPURITY DISTRIBUTION IN A TURBULENT FLOW OF MOLTEN METAL COOLANT M. N. Ivanovskiy, Yu. I. Orlov, and V. I. Subbotin p 68–78 refs (See N67-28178 15-22)

6. STUDY OF THE POSSIBILITY OF MONITORING IMPURITIES IN MOLTEN METAL COOLANTS BY MEASURING ELECTRICAL RESISTANCE M. N. Arnol'dov, M. N. Ivanovskiy, V. I. Subbotin, and B. A. Shmatko p 79–88 refs (See N67-28179 15-22)

N67-28174 Joint Publications Research Service, Washington, D. C.
COMPOSITION AND DISTRIBUTION OF IMPURITIES, THEIR CONTROL AND REMOVAL FROM CIRCULATING ALKALI METAL COOLANTS
A. I. Leypunskiy, V. I. Subbotin, and M. N. Ivanovskiy *In its* Sodium-Coolad Nucl. Reactors 24 Feb. 1967 p 1–17 refs (See N67-28173 15-22)
(SM-85/41)

The reduction of operating characteristics of alkali metal reactor coolants due to the presence of impurities in the coolant current is described. Sources of impurity contamination (water from steam, gases from circuit, and ambient gases from atmosphere); and the composition and distribution of impurities found in the circulating coolant, are discussed. Methods of controlling the content of impurities entering the current; and flow and diffusion cold trap techniques for continuously purifying the coolants are described. L.S.

N67-28177 Joint Publications Research Service, Washington, D. C.

STUDY OF SODIUM PURIFICATION BY HIGH-EFFICIENCY COLD DIFFUSION TRAPS

M. N. Arnol'dov, M. N. Ivanovskiy, V. I. Subbotin, and B. A. Shmatko *In its* Sodium-Cooled Nucl. Reactors 24 Feb. 1967 p 54–67 refs (See N67-28173 15-22)
(SM-85/47)

The conditions under which diffusion traps are efficient were investigated. The parameters governing the efficiency of trap performance include the trap capacity with respect to accumulated impurities, the purification rate, and the minimally attainable impurity concentration in the loop. In the study it was shown that cold diffusion traps permit organizing of the purification process in such a way that practically speaking complete filling of the cold trap with impurities is realized. The traps are of low sensitivity to changes in the consumption of metal in the lines in which they are installed and are not clogged with impurities at any practical impurity concentrations at the trap entrance and upon sharp change in concentration. Author

N67-28178 Joint Publications Research Service, Washington, D. C.

STUDY OF IMPURITY DISTRIBUTION IN A TURBULENT FLOW OF MOLTEN METAL COOLANT

M. N. Ivanovskiy, Yu. I. Orlov, and V. I. Subbotin *In its* Sodium-Cooled Nucl. Reactors 24 Feb. 1967 p 68–78 refs (See N67-28173 15-22)
(SM-85/52)

Results are presented of an experimental investigation of the distribution of insoluble impurities (nitrogen) in a turbulent flow of lithium coolant as a function of various factors: temperature and flowrate of coolant, direction of the heat flow, and operating conditions of individual assemblies and of entire circulation loop. A solution to the differential equation of the material balance of impurities per unit contact layer surface is presented. Author

N67-28179 Joint Publications Research Service, Washington, D. C.

STUDY OF THE POSSIBILITY OF MONITORING IMPURITIES IN MOLTEN METAL COOLANTS BY MEASURING ELECTRICAL RESISTANCE

M. N. Arnol'dov, M. N. Ivanovskiy, V. I. Subbotin, and B. A. Shmatko *In its* Sodium-Cooled Nucl. Reactors 24 Feb. 1967 p 79–88 refs (See N67-28173 15-22)
(SM-85/48)

A direct current double bridge was used to measure the specific resistance of lithium at a temperature of 300°C as a function of the nitrogen, oxygen, and hydrogen content; and to measure the specific resistance of sodium at a temperature of 350°C as a function of the oxygen and hydrogen content. The metals circulated through a closed tube steel loop fitted with a pump for evacuating the metal, and a device for measuring the feeding in of gases into the liquid metal. The results are plotted. The data agree with some literature work in the same area but departed from other literature results. Also determined was the change in the electrical resistance of sodium upon the introduction of hydrogen. L.S.

N67-28208# General Dynamics Corp., San Diego, Calif. General Atomic Div.

ADVANCED BERYLLIUM OXIDE CONCEPTS Quarterly Progress Report, Period Ending 30 Jun. 1966

29 Jul. 1966 26 p *ref*
(Contract AT(04-3)-187)
(GA-7333) CFSTI: HC$3.00/MF$0.65

Data on fission product release from sweep capsule F-7 containing BeO-matrix fuel are reported. Information is included on preparation of BeO samples under fabrications conditions comparable to those for BeO matrix fuel. Data and information are also included on Cs diffusion in BeO. Properties of UOX BeO powders were examined and data are included on sintering powders of this grade. Data are also included on radiation and temperature effects on BeO-matrix fuel. Other data and information are included on properties of irradiated and unirradiated graphite. NSA

N67-28211# Maschinenfabrik Augsburg-Nurnberg A. G., Nuremberg (West Germany).

STUDY ON BURNOUT HEAT FLUX IN BOILING WATER Quarterly Report No. 17, 1 Oct.–31 Dec. 1965

F. Mayinger, O. Schad, and E. Weiss Jan. 1966 42 p
(Contract EURATOM-057-61-RDD)
(EURAEC-1550; EUR-2892) CFSTI: HC$3.00/MF$0.65

Under certain hydrodynamic, thermodynamic and structural conditions pulsations can be set up in heated channels which cause burnout at a much lower critical heat flux than is the case with normal film boiling under stable flow conditions. Compressible media increase the tendency toward pulsations upstream of the heated channel, while orifices reduce them. Studies were performed to determine the minimum orificing necessary at the inlet of the heated channel to prevent these pulsations. Author (NSA)

N67-28212# Societe Nationale d'Etude et de Construction de Moteurs d'Aviation, Suresnes (France). Division Atomique.

SWIRL FLOWS IN BOILING WATER. CRITICAL FLUX IN SWIRL FLOW IN A TUBE

A. Rosuel, G. Sourioux, J. Dolfe, and J. Sandrin 18 Oct. 1965 45 p refs *Its* Spec. Rept.-21
(Contract EURATOM-0-61-64-7-TEE-F(RD)
(EURAEC-1544) CFSTI: HC$3.00/MF$0.65

The influence of the heating length of the channel, mass velocity, and fluid enthalpy at the heating channel inlet were examined in defining the critical flux in swirl flow. Tubular geometry was used to facilitate calculation of local quality at right angles to burnout. Tests showed that centrifugation of a two-phase water-steam mixture had a considerable effect on the thermal performance of a heating channel. It was impossible to obtain any considerable subsaturation, but with 4% subsaturation, it was possible to reach 100% exit quality. The influence of mass velocity tends to increase the fluxes. The effect of centrifugation on critical flux was not fully clarified but it does increase the flux. It is impossible to extrapolate the results to different geometries, in particular to rod clusters. NSA

N67-28301# Commissariat a l'Energie Atomique, Grenoble (France). Service d'Electronique.

STUDIES ON THE USE OF CALCULATORS IN REAL TIME. REACTOR CONTROL AND THE TREATMENT OF THE INFORMATION FROM ASSOCIATED EXPERIMENTS [NOTE D'INFORMATION SUR L'EMPLOI DES CALCULATEURS EN TEMPS REEL. CONTROLE DU REACTEUR ET TRAITEMENT D'INFORMATION DES EXPERIENCES ASSOCIEES]

R. Gariod and J. J. Girod 1 Feb. 1965 63 p refs In FRENCH *Its* Internal Note EL/65-1339 revised
(NP-16490)

The use of computers for centralized reactor control and processing of data from associated experiments is presented. A possible configuration is indicated for such a centralized system beginning with a quantitative knowledge of the problem. The steps which should be followed are the formulation of the problems posed by the control of the reactor operation and the auxiliary installation, the acquisition of experiment data, and the processing of these data. The problems posed by the utilization of computers are outlined. NSA

N67-28307# Kernforschungszentrum, Karlsruhe (West Germany). Institut fuer Angewandte Reaktorphysik.
SUPPLEMENTARY MATERIAL TO THE REPORT "NUCLEAR FUEL REQUIREMENTS AND COSTS OF VARIOUS REACTOR TYPES IN GERMANY" (KFK 366) [ERGAENZENDES MATERIAL ZUM BERICHT "KERNBRENNSTOFFBEDARF UND KOSTEN VERSCHIEDENER REAKTORTYPEN IN DEUTSCHLAND" (KFK 366)]
H. Gruemm, D. Gupta, W. Haefele, P. Jansen, M. Recker (Tech. Hochschule Aachen) et al Sep. 1966 310 p refs In GERMAN
(KFK-466)

The background material used in the preparation of the report KFK-366 is presented. A detailed representation is given of the analytical and numerical calculation methods. The projects discussed are nuclear fuel reserves and price development, nuclear energy reserves and the economy of nuclear power plants, mathematical model transformation of nuclear fuel elements in combined reactor systems, cost calculation, fuel cycle for reactors, estimation of future energy needs, and characteristic reactor data.
NSA

N67-28308# Kernforschungszentrum, Karlsruhe (West Germany). Institut fuer Reaktorentwicklung.
CALCULATION PROGRAM FOR THE DYNAMICS AND STABILITY OF A FAST POWER REACTOR [RECHENPROGRAMME FUER DYNAMIK UND STABILITAET EINES SCHNELLEN LEISTUNGSREAKTORS]
W. Frisch and E. Schoenfeld Jun. 1966 82 p refs In GERMAN
(KFK-465)

In order to analyze sodium-cooled fast power reactors the present calculation programs were developed for dynamics studies and stability calculations. An analog program permits dynamic studies of the core and the primary coolant system. In this program the most important nonlinearities were considered so that the larger perturbations could be studied. For the stability investigations two Fortran programs were available with which various frequency pairs could be calculated which described the transition behavior of the core. Application of this digital program to other coolants as H_2O vapor is possible.
Author (NSA)

N67-28309# Japan Atomic Energy Research Inst., Tokyo.
NUCLEAR, THERMAL-HYDRAULIC PERFORMANCE ANALYSIS OF JPDR CORE BY THE ONE-DIMENSIONAL BWR CORE PERFORMANCE ANALYSER CODE, KINAK
Yasushi Kuge, Michio Ishikawa, Yoshitaka Naitoh, and Tadahiro Itoh May 1966 43 p refs In JAPANESE; ENGLISH summary
(JAERI-1114)

The core performance of JPDR (a natural circulation BWR) was analyzed by the one-dimensional BWR core performance analyzer code, KINAK. This code is used to compute the nuclear, thermal-hydraulic performance of a BWR core by a comprehensive scheme. The axial power distribution, the power and void coefficients of reactivity and the excess reactivity at the rated power level were calculated and compared with those measured at JPDR (or the GE design values). Results of these comparative studies are used as a basis for the conclusion that the computational model of the code and nuclear group constants used are able to represent the nuclear performance of the JPDR core within reasonable accuracy. There exists a discrepancy of about 10% between the calculated values and those measured by the instrumented fuel assembly of the recirculation flow rate and the core exit quality. The calculated recirculation flow rate is estimated to be the lower bound of the actual flow rate. Computation of the fuel center temperature and the minimum burnout ratio indicates that JPDR is operated with a wide margin with respect to the thermal design limit at its rated power. The parametric study at the rated power as well as the feasibility study at the double power with the forced circulation system are additionally performed.
Author (NSA)

N67-28310# General Dynamics Corp., San Diego, Calif. John Jay Hopkins Lab. for Pure and Applied Science.
FLUX DISTRIBUTION MEASUREMENTS IN PEACH BOTTOM: RESULTS OF POST CONSTRUCTION R AND D TEST PROCEDURES BP-8, 10, 12
R. K. Lane and A. L. Weiman 1 Oct. 1966 115 p
(Contract AT(04-3)-314)
(GAMD-7353) CFSTI: HC $3.00/MF $0.65

Results of flux mapping experiments in the reactor are presented. The theory-experiment correlations are included, and the experimental methods and data reduction methods are described.
NSA

N67-28312# Technische Hogeschool, Eindhoven (Netherlands).
THE STEADY STATE AND DYNAMIC BEHAVIOR OF A BOILING WATER REACTOR Quarterly Progress Report, 1 Apr.–1 Jul. 1966
Jul. 1966 22 p refs
(Contract EURATOM-030-64-1 TEEN)
(EURAEC-1745; EUR-3305; QPR-22; WW-016-R-111) CFSTI: HC $3.00/MF $0.65

A series of experiments was carried out to investigate the influence of the heat capacity of a heating element on the characteristics in steady state as well as in non-steady state conditions. The previously used tabular element was replaced by a solid bar having the same outer dimensions but a different heat capacity. The independent variables during the experiments were power, pressure, and subcooling. The experiments did not show an effect on the steady state data nor on the threshold of instabilities. Measurements of the transfer function from power to the inlet flowrate did not indicate a significantly different stability of the system.
Author (NSA)

N67-28313# Technische Hogeschool, Eindhoven (Netherlands).
HEAT TRANSFER AND FLUID FLOW CHARACTERISTICS IN A PRESSURIZED WATER REACTOR Quarterly Report, 1 Apr.–1 Jul. 1966
Aug. 1966 22 p
(Contract EURATOM-011-64-1-TEEN (RD))
(EURAEC-1724; EUR-2898; QR-10; WW-015-R-113) CFSTI: HC $3.00/MF $0.65

Experiments were carried out that were mainly connected with the instrumentation of the mixing test section. A test section was built to calibrate void-gages outside the pressure loop. Tests were also done in the pressurized loop on newly constructed void gages. Reproducibility runs were done with the air–water loop and an analysis of the results obtained with this loop was started. A theoretical study on the hydraulic coupling of parallel channels is being continued.
Author (NSA)

N67-28314# Ente Nazionale per l'Energia Elettrica (ENEL), Latina (Italy).
RESEARCH PROGRAM FOR THE GARIGLIANO NUCLEAR POWER PLANT Quarterly Report, Jan.–Mar. 1966
1 Apr. 1966 8 p
(Contract EURATOM-101-63-11-RDI)
(EURAEC-1653; EUR-2851; QR-8) CFSTI: HC $3.00/MF $0.65

Operating experience of the power plant is reported. Attention is directed particularly toward control systems. Information is included on operation of the data logging computer system, performance of instrumented assemblies, studies of test procedures, and control rod oscillator studies.
NSA

N67-28316# General Electric Co., Pleasanton, Calif. Nuclear Technology Dept.

RECENT FAST CRITICAL EXPERIMENTS IN THE MSCA AND 710-CE

G. T. Petersen, J. F. Kunze, I. B. Wall, W. B. Henderson, J. W. Hallam et al Oct. 1966 28 p refs Presented at Intern. Conf. on Fast Critical Expt. and their Analysis, Argonne, Ill., 10–13 Oct. 1966

(Contract AT(04-3)-189; AT(40-1)-2847)

(CONF-661019-10) CFSTI: HC $3.00/MF $0.65

The fast core of the Mixed Spectrum Critical Assembly (MSCA) or the Vallecitos Atomic Laboratory, contains a loading of enriched UO_2, natural UO_2, and Inconel. The neutron spectrum in this assembly is spatially asymptotic and representative of a dilute fast ceramic reactor. Measurements reported include fission rates of ^{233}U, ^{234}U, ^{235}U, ^{236}U and ^{237}Np. Nutron life-time determined by pulsed neutron and 1/V poison substitution, and reactivity worths determined by pile oscillator and direct period measurements are reported. At the Idaho Test Station, work in the 710-CE concentrated on small, hard spectrum, refractory metal critical experiments related to space power reactor applications. Be reflected cores in the 20 to 50 liter range, containing essentially equal volume mixtures of W, fully enriched U metal and Ta are studied. Data from the first basic critical experiment include central fission ratios, reflector effects on power distribution and neutron lifetime, and relative reactivity worths. Author (NSA)

N67-28345# Atomic Energy Commission Research Establishment, Riso (Denmark).

METALLURGY DEPARTMENT ANNUAL PROGRESS REPORT FOR THE PERIOD ENDING 31 MARCH 1966

Sep. 1966 49 p

(RISO-139)

Developments are reported for studies on: UO_2–Zircaloy fuel elements for water reactors; metallography of Zircaloy-2; hydrogen determination in Zircaloy-2; examination of failed SAP tube; metallography of irradiated U alloys, UO_2, and SAP; corrosion of Zircaloy-2 and a standard MTR-type fuel element; uptake of hydrogen from terphenyls by SAP; texture of extruded Al–Al_2O_3; rolling textures in fcc metals and alloys; hydrogen determination in SAP; fission-fragment damage in dilute Al–Mg alloys; production of Al–Al_2O_3 single crystals; mechanical properties and structure of Al–Al_2O_3 creep properties of Al–Al_2O_3; activation energy of Al–Al_2O_3; irradiation growth of dilute uranium alloys; instrumentation; development and properties of MTR-type fuel element and Zircaloy–UO_2; creep properties of Al–Al_2O_3 products made from atomized aluminum powders; grain size of Al powder; and preparation of UO_2 pellets. NSA

N67-28358# Bettis Atomic Power Lab., Pittsburgh, Pa.

PLASTIC-SASS: A FORTRAN IV COMPUTER PROGRAM FOR STRESSES AND DEFLECTIONS IN A REACTOR SUBASSEMBLY UNDER THERMAL, HYDRAULIC, AND FUEL EXPANSION LOADS

W. D. Long, Jr. Dec. 1966 6 p

(Contract AT(11)-1)-GEN-14)

(WAPD-TM-312; Add. 1) CFSTI: HC $3.00/MF $0.65

PLASTIC-SASS-3 is described. This program can be used in analyses in which assignment of different growth characteristics to each region of subassemblies and specification of anisotropic behavior to the material of each region is required. NSA

N67-28359# Bettis Atomic Power Lab., Pittsburgh, Pa.

FABRICATION OF FUEL RODS CONTAINING U-233 PELLETIZED OXIDE FUELS

W. L. Frankhouser, H. H. Crain, R. L. Fischer, J. H. Suldan, J. H. Eyler et al Feb. 1967 45 p

(Contract AT(11-1)-GEN-14)

(WAPD-TM-588) CFSTI: HC $3.00/MF $0.65

Approximately 13 kg of U-233 were fabricated into 1 wt % UO_2–ThO_2 and 26 wt % UO_2–ZrO_2 pellets and enclosed in Zircaloy-2 cladding tubes as 1299 blanket and 377 seed rods. The U-233 contained 38 ppM of U-232, and was purified as two batches of liquid $UO_2(NO_3)_2$ immediately prior to processing into powder form. All fuel rods were completed within 95 days of this initial solvent extraction of the nitrate. Overall U yield of nitrate to usable materials was over 90%, and only 14 rods were rejected in welding and all without loss of contained fuel. Author (NSA)

N67-28360# Bettis Atomic Power Lab., Pittsburgh, Pa.

MEASUREMENT OF THE EFFECTIVE RESONANCE INTEGRAL AND DOPPLER COEFFICIENT OF THORIUM OXIDE RODS

B. L. Palowitch and J. Hardy, Jr. Dec. 1966 47 p refs

(Contract AT(11-1)-GEN-14)

(WAPD-TM-627) CFSTI: HC $3.00/MF $0.65

The effective resonance capture integral of ThO_2 was measured, at temperatures of 300° and 1200°K, for rods ranging in diameter from 0.4 to 3.0 cm. Calculated resonance integrals obtained using current cross sections and calculational methods are found to be in good agreement with the experimental results. Author (NSA)

N67-28408# Ceskoslovenska Akademie Ved. Rez. Ustav Jaderneho Vyzkumu.

MEASUREMENT OF THE FAST NEUTRON FLUX BY THRESHOLD ACTIVATION DETECTORS [MERENI TOKU RYCHLYCH NEUTRONU PRAHOVYM AKTIVACNIM DETEKTOREM]

S. B. Rana Dec. 1966 28 p refs In CZECHOSLOVAKIAN; ENGLISH summary

(UJV-1712)

The measurement of fast neutron flux by threshold activation detectors, in a reactor core where the spectrum above about 0.5 MeV can be assumed to be a fission one, is discussed. A survey of threshold detectors and directions to choose a suitable detector are also given. The reaction ^{58}Ni (n,p) ^{58}Co was chosen for routine fast flux measurements in the VVR-S reactor; and the experimental results are shown graphically. Author (NSA)

N67-28414# Union Carbide Corp., Oak Ridge, Tenn. Y-12 Plant.

EVALUATION OF SEAT MATERIALS FOR PRESSURIZER STEAM RELIEF VALVE

W. E. Weathersby, F. J. Lambert, Jr., E. E. Dunn, and J. M. Googin 1 Nov. 1966 100 p

(Contract W-7405-ENG-26)

(Y-EF-22) CFSTI: HC $3.00/MF $0.65

An investigation was made to improve the leak tightness of commercial steam pressure relief valves such as required in a steam pressurizer used as part of a reactor control system. Laboratory studies and leak tests were carried out on various materials including noble metals and their alloys, Stellites, tungsten carbide, and aluminum oxides. The effects of surface finishes and piping configurations were evaluated. None of the materials tested met all the requirements for leak-tight seating surfaces under the specified condition of repeated valve relieving. However tests of limited duration indicated that the Stellite and tungsten carbide seating surfaces were leak-tight until the valve was relieved. It is theorized that a cermet of aluminum oxide with a small percent of platinum as a binder is worth future investigation. NSA

N67-28425# Westinghouse Electric Corp., Pittsburgh, Pa. Atomic Power Div.
EFFECT OF THE MODERATOR COEFFICIENT ON CORE STABILITY
R. J. French, L. E. Strawbridge, and R. F. Barry Sep. 1966 42 p refs
(WCAP-2987) CFSTI: HC $3.00/MF $0.65

An analytic model is developed to evaluate the effect of the moderator temperature coefficient on core stability. The model includes the effects of delayed neutrons, the delay times for heat transfer in the fuel and coolant and the interaction of flow changes on spatial stability. A stability criterion is derived from this model. The magnitude of the moderator temperature coefficient which results in an unstable core condition is expressed in terms of the Doppler coefficient, core leakage, and thermal and hydraulic parameters. When conservative values are used for the nuclear, thermal, and hydraulic parameters, the threshold moderator coefficient in a large high performance PWR is estimated to be $+1.5 \times 10^{-4}$/°F.
Author (NSA)

N67-28426# Westinghouse Electric Corp., Pittsburgh, Pa. Atomic Power Div.
PRESSURIZED WATER REACTOR pH-REACTIVITY EFFECT Technical Progress Report, Period Ending 30 Sep. 1966
Oct. 1966 51 p refs
(Contract AT(30-1)-3696)
(WCAP-3696-1; EUREAC-1723) CFSTI: HC $3.00/MF $0.65

Tests were conducted at the Saxton Reactor which included power swings at different pH conditions. In support of these tests calculations of the Xe behavior during the experiment were carried out. Dynamic measurements performed during the Saxton tests indicate that the pH-reactivity effect is associated with power defect. Calculations were carried out to determine the reactivity effect of a uniform deposit of Fe_3O_4 in the Yankee and Saxton cores. The results indicate that 1000 mg/dm^2 deposited or removed from the core surfaces in Saxton would explain the full typical short term reactivity changes due to pH in the Saxton Reactor, while approximately 1500 mg/dm^2 would account for the typical short term reactivity change observed in Yankee pH tests. Work was initiated on the design of an instrumented fuel subassembly for the Saxton Reactor. The feasibility of crud detection by measurement of the change in fuel centerline temperature was investigated for UO_2, cermet, and alloy fuels. Based on these calculations and on manufacturing evaluations, a UO_2-300 series stainless steel cermet was specified as the reference fuel for the instrumented rods. Preliminary UO_2 enrichments were established and vendor sources were investigated. Design work was initiated on a test section, to be used in an existing loop, for out-of-pile studies on the pH effect. Synthesized corrosion products will be injected into the test section and heat transfer measurements will be performed at various pH conditions on any deposits formed on simulated fuel rods.
Author (NSA)

N67-28447# Comitato Nazionale per l'Energia Nucleare, Rome (Italy).
COMPARISONS OF THEORETICAL AND EXPERIMENTAL DATA ON THE CONTROL RODS IN GARIGLIANO REACTOR (WATER MODERATED UO_2 REACTOR) [CONFRONTO TEORIA-ESPERIENZA NEL CALCOLO DELLE BARRE DI CONTROLLO DEL REATTORE DEL GARIGLIANO]
G. Manca 1966 31 p refs In ITALIAN
(RT/FI/66/-16)

The application and validity of some methods used in control rod calculations in light water moderated UO_2 thermal reactors are studied. The comparison between theory and experience is made by utilizing data obtained from the Garigliano reactor.
Author (NSA)

N67-28453# Los Alamos Scientific Lab., N. Mex.
SUMMARY OF COUPLED KIWI EXPERIENCE
Herbert Helmick and Curtis G. Chezem [1967] 8 p Presented at the Am. Nucl. Soc. Coupled Reactor Kinetics Conf., College Station, Tex.
(Contract W-7405-ENG-36)
(LA-DC-8516; CONF-670107-3) CFSTI: HC $3.00/MF $0.65

The neutronic stability of a two-core cluster of nuclear rocket engines of the Kiwi and Phoebus I class was confirmed by measurements of transfer functions and pulsed neutron source behavior. Techniques for computing the coupling parameters and power perturbations were verified by static measurements on the coupled system.
NSA

N67-28455# Kernforschungszentrum, Karlsruhe (West Germany).
THE PROGRAM SYSTEM TERM-1 [DAS PROGRAMMSYSTEM TERM-1]
W. Gmelin Aug. 1966 70 p refs In GERMAN
(KFK-462)

The TERM-1 program was developed for the time monitoring of the Karlsruhe fast breeder project. The fundamentals of the network-planned technique, on which the TERM-1 program is based, were described and illustrated on the basis of some examples of the input and output conventions in the operation of the TERM-1 program. In the appendix the calculation of a network plan, the flow diagram, and the program list of the TERM-1 are given.
NSA

N67-28457# General Dynamics Corp., San Diego, Calif. John Jay Hopkins Lab. for Pure and Applied Science.
HIGH-TEMPERATURE GAS-COOLED REACTOR FUELS AND FUEL CYCLES—THEIR PROGRESS AND PROMISE
S. Jaye and W. V. Goeddel 10 Dec. 1966 30 p refs Presented at the Am. Nucl. Soc. Winter Meeting, Pittsburgh, 31 Oct.–3 Nov. 1966
(Contracts AT(04-3)-633; AT(04-3)-167)
(GA-7482; CONF-661001-45) CFSTI: HC $3.00/MF $0.65

The fuel and fuel cycles of high-temperature helium-cooled reactors are examined. The requirements placed on the fuel container, how these requirements have been achieved, several potentially attractive fuel cycles, and some likely fuel cycle costs in large HTGRs are discussed.
NSA

N67-28458# Societe Belge Pour l'Industrie Nucleaire, Brussels (Belgium).
USE OF PLUTONIUM AS A FUEL IN NUCLEAR REACTORS Quarterly Report, 1 Apr.–30 Jun. 1966
Sep. 1966 81 p refs
(Contract EURATOM-001-64-1 TRUB)
(QR-10; BN-6609-30; EURAEC-1742; EUR-3302) CFSTI: HC $3.00/MF $0.65

Two procedures for fusion of mixed fuel powders using high-frequency currents were tested. They are characterized by the direction in which the load moves. The conditions for welding plugs to thin cans (0.25 mm Incoloy) were defined for swaged-type rods. The shape of the rod plugs for irradiation tests in capsules was improved. During vibration compacting of fuel rods for neutron tests, analysis of the gamma activity showed similar distribution whether measured on a single generator or on four. An automatic counter of residual gamma contamination was installed. Initial results appear to agree with previous measurements. The reprocessing of liquid wastes by dry evaporation, followed by low temperature roasting, was found satisfactory. At the present status of research, 510 W/cm is adopted as the mean power generated in the middle of the central rod irradiated in the second series of irradiation tests on the BR-2 reactor hydraulic conveyor. On the basis

of quantimetric measurements, the mean power was estimated at 770 W/cm in the middle of the central rod irradiated in the third set of BR reactor tests. The second boiling water capsule was unloaded following the detection of a leak. Development of the determination of ^{148}Nd as an indicator of the burn-up ratio was started. The evolution of the isotopic composition induced by fission neutron capture was examined theoretically. The Cadilhac code used for neutron spectra in heterogeneous media was adapted to the two specific cases of the Spectrox and Amoyal–Benoist (ABH) methods. The experimental program of sub-critical approximations on VENUS/Vulcain fuel was clarified. The purpose of the last two stages of the program is to measure the effect of poisoning in the reflector and the core respectively. A standard isotopic composition representative of those provided for Pu recycling purposes, and optimization methods were developed in Pu recycling studies. NSA

N67-28462# Westinghouse Electric Corp., Pittsburgh, Pa.
THE MANUFACTURE OF ThO_2–UO_2 CERAMIC BODIES
M. Gabaglio and A. Liscia [1967] 28 p refs Transl. into ENGLISH from Energ. Nucl. (Milan), v. 13, 1966 p 173–181 Presented at Conf. on Fissile Mater. in Nucl. Reactors, Milan, 29 Nov.–1 Dec. 1965
(WAPD-TRANS-42; CONF-651151-42)

Research and development on sintered ThO_2–UO_2 fuels to support the program for the Thorium and Uranium Oxide Fuel Reprocessing and Fabrication Plant of CNEN are reviewed. Experiments carried out to investigate the best conditions of sintering a mixed thorium–uranium oxide containing 4% in uranium are described. Methods of preparation of starting coprecipitate, calcination, and sintering conditions were determined. Experiments in order to obtain on pilot-scale, ceramic compounds with density 95% of theoretical together with two different length–diameter ratios are described. The ratios between 1 and 2 are for pellets obtained employing the pressing technique; the ratio of about 10 was obtained by extrusion. The results indicated that the extrusion method is more convenient. Author (NSA)

N67-28469# Los Alamos Scientific Lab., N. Mex.
WHY COUPLED FAST BREEDER REACTORS?
W. H. Hannum and J. J. Prabulos, Jr. Jan. 1967 11 p refs
(Contract W-7405-ENG-36)
(LA-DC-8288; CONF-670107-2) CFSTI: HC $3.00/MF $0.65

Many observations have been forwarded in support of coupled reactors. Some of these are valid for central-station fast breeders. The incentives, other than safety, for going to a modular or other coupled arrangement are small, except in cases where extensive neutron spectrum tailoring is needed. Some caution is required in utilizing the attractive reactivity coefficients of a coupled system to ensure that they are valid throughout the reactor cycle. Author (NSA)

N67-28471# Westinghouse Electric Corp., Pittsburgh, Pa. Atomic Power Div.
CONTROL OF XENON INSTABILITIES IN LARGE PWR'S Technical Progress Report, Period Ending 10 Sep. 1966
Oct. 1966 18 p refs
(Contract AT(30-1)-3680)
(WCAP-3680-1; EURAEC-1721) CFSTI: HC $3.00/MF $0.65

Studies performed have demonstrated that the selected calculational procedures are acceptable for the initial phases of the program. An x–y calculation without Doppler damping was performed for a large PWR core to establish the characteristics of a free-running, divergent oscillation. This calculation was carried through several cycles of the Xe oscillation so that the rate of divergence could be determined. The x–y case seems to be less stable than expected. Comparisons of predicted Xe stability in the x–y plane were then made for full-core calculations, full-core calculations with 45° symmetry, and half-core symmetric calculations. From these comparisons it appears possible to perform some of the analyses with symmetric calculations which reduce computer running time. For corrective control action, however, full-core calculations will probably be required. A calculation that included a pointwise Doppler coefficient was also performed to observe its stabilizing effect. However, this calculation required an excessive amount of computer time, and alternate calculational approaches are being considered. Author (NSA)

N67-28474# Idaho Nuclear Corp., Idaho Falls.
A SUMMARY OF DATA FROM THE ATRC EXPERIMENTAL PROGRAM
J. W. Henschied, N. C. Kaufman, and J. L. Durney Feb. 1967 78 p refs
(Contract AT(10-1)-1230)
(IN-1053) CFSTI: HC $3.00/MF $0.65

A summary of the results of the Advanced Test Reactor Critical Facility (ATRC) experimental program relating to the operation of the ATR is presented. Included in the report are startup proceedings, shutdown reactivity in safety rods, kinetic parameter measurements, shim calibrations, excess reactivity measurements, void reactivity effects, experimental reactivity effects, neutron flux and power distribution measurements, and outer shim rotation reversal effects. NSA

N67-28475# Atomic Power Development Associates, Inc., Detroit, Mich.
RESULTS OF THE LOW-POWER NUCLEAR TEST PROGRAM FOR THE ENRICO FERMI FAST BREEDER REACTOR
George L. Ball et al Feb. 1967 128 p refs
(Contract AT(11-1)-865)
(APDA-302) CFSTI: HC $3.00/MF $0.65

Procedures and results of the low-power nuclear test program for the first core loading of the Enrico Fermi fast breeder reactor are summarized. Included are (1) a description of the reactor proper, along with its auxiliary equipment and instrumentation; (2) the background and objectives of the nuclear testing effort; (3) the test procedures; and (4) the actual test results as well as a comparison of these results with previously predicted values. Where applicable, the test results are evaluated in terms of realization of the objectives, use and application in future test programs, and accuracy. Author (NSA)

N67-28477# Los Alamos Scientific Lab., N. Mex.
HIGH FREQUENCY TRANSFER FUNCTION MEASUREMENTS FOR COUPLED FAST POWER REACTORS
Carl A. Anderson, Jr. [1967] 42 p refs Presented at the Am. Nucl. Soc., Coupled Reactor Kinetics Conf., College Station, Tex.
(Contract W-7405-ENG-36)
(LA-DC-8299; CONF-670107-1) CFSTI: HC $3.00/MF $0.65

The reasons for, and problems of, measuring transfer functions of fast power reactors in general are discussed with emphasis on the need for measurements of coupled fast power reactor transfer functions in the high frequency domain. The measuring techniques are analyzed; use of an intense pulsed neutron source is found to be of particular interest. Author (NSA)

N67-28492# Kernforschungszentrum, Karlsruhe (West Germany). Institut fuer Angewandte Kernphysik.

HIGH RESOLUTION CROSS-SECTION MEASUREMENT FOR SOME FAST REACTOR STRUCTURAL MATERIALS IN THE KeV ENERGY RANGE

G. Rohr, E. Friedland, and J. Nebe Oct. 1966 14 p refs Presented at Intern. Atomic Energy Agency Conf. on Nucl. Data-Microscop. Cross-Sect. and other Data Basic for Reactions, Paris, 17–21 Oct. 1966

(KFK-452; CONF-661014-47)

Transmission measurements of the neutron total cross sections of Fe, ^{57}Fe, ^{55}Mn, and ^{51}V at 20 to 250 keV were made using the time-of-flight method. A multilevel analysis of the data for ^{55}Mn and ^{51}V yielded resonance parameters for these isotopes, and an area analysis of the data on Fe yielded resonance parameters for ^{56}Fe. NSA

N67-28521# Oak Ridge National Lab., Tenn.

FABRICATION OF TARGET ELEMENTS FOR THE HIGH-FLUX ISOTOPE REACTOR

J. D. Sease Mar. 1967 113 p

(Contract W-7405-ENG-26)

(ORNL-TM-1712) CFSTI: HC $3.00/MF $0.65

Thirty-seven High-Flux Isotope Reactor target elements, 31 of which will comprise the first High-Flux Isotope Reactor target assembly, were fabricated. The 3/8-in.-dia Al clad elements each contain 8 g of ^{242}Pu in the form of 35 Al-jacketed pellets of PuO_2 dispersed in Al and pressed to 90% of theoretical density. The pellets were sealed by welding in a He-filled finned Al tube, which was then canned in a cylindrical Al sheath. In addition, 38 simulated High-Flux Isotope Reactor elements that contain 10% enriched UO_2 and Ta to match the heat generation and cross section of the ^{242}Pu target elements and 19 High-Flux Isotope Reactor target elements that each contain 10 g ^{242}Pu for irradiation at Savannah River Laboratory were fabricated. The design and fabrication of these elements are described along with results of examination of the completed elements, including photographs, radiographs, and complete dimensional data. In the description of the fabrication procedure two developments of major significance are discussed. One is the development of a blending–dispensing technique for the PuO_2–Al core mixture. The second is a unique welding joint design and welding procedure that minimizes the "blowout" problem in closure welds on the 3/8-in.-dia thick-walled Al target tubes. Author (NSA)

N67-28522# Polish Academy of Sciences, Warsaw. Inst. of Nuclear Research.

SOME EXPERIMENTS ON VIBRATIONAL COMPACTING B_4C FOR REACTOR CONTROL RODS

W. Rutkowski, W. Szteke, and M. Wieczorkowski Mar. 1966 20 p refs

(INR-701/XIV/PS)

Some experiments on vibrational densification of B_4C for reactor control rods were made. Higher densities of the B_4C cores were obtained using the hot-pressing technique. Lower densities could be obtained in a vibrational densification process. The control rods were tested in the reactor. Experimental results are presented. Author (NSA)

N67-28643*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

NUCLEAR ELECTRIC POWER

In its Res. and Advanced Develop., Vol. II 31 Jan. 1967 p 25–43 refs (See N67-28641 15-34)

Overall objective of the nuclear electric power program is to determine the potential and the integration problems of unmanned lunar and planetary space science programs. The integration of a radioisotope thermoelectric generator (RTG) with various types of unmanned spacecraft is considered. Liquid and refractory metal systems applicable to nuclear reactor and power conversion systems are being studied, including the conceptual feasibility of liquid metal magnetohydrodynamic (MHD) systems. Life and performance testing of thermoelectric generators for space power sources are reported, and out-of-pile nuclear thermionic converters are being evaluated. M.W.R.

N67-28673 Deutsche Forschungsanstalt fur Luft- und Raumfahrt, Brunswick (West Germany). Institut fuer Strahlantriebe.

CALCULATION OF THERMAL NEUTRON FLUX-SPECTRA AND NUCLEAR-CONSTANTS FOR REACTOR DESIGN [BERECHNUNG THERMISCHER NEUTRONENFLUSSSPEKTREN UND GRUPPENKONSTANTEN FUER KERNREAKTOREN]

W. Rasch Dec. 1966 48 p refs In GERMAN; ENGLISH summary

(DLR-FB-66-91)

The computer program THERMOGRUP 6 is a dimensionless reactor-code to calculate the flux of thermal neutrons in the energy range of $0 \leq E \leq 1.68$ eV. It contains an extensive collection of thermal neutron cross-sections (84 elements). Tests with the new programs showed better results than with the older codes. This is caused by improvements in the theory and the numerical technique. Author

N67-28813# Lockheed Missiles and Space Co., Palo Alto, Calif.

LOOP DOSE TRANSFORMER

S. V. Starodubtsev, I. Kh. Abdukadyrova and V. V. Generalova [1967] 3 p refs Transl. into ENGLISH from Izv. Akad. Nauk Uz. SSR, Ser. Fiz. Mat. Nauk (Tashkent), no. 1, 1966 p 62–63

In studying the dynamics of processes of radiation polymerization and of organic compound synthesis in powerful nuclear radiation fluxes, it is convenient to have a dosimeter unit with whose aid the range of the dose to be measured can be varied by utilizing the same dosimeter system and recording unit. The operating principle of the loop dosimeter is described which is based on recording physico-chemical changes in aqueous solutions of glucose circulating through the active zone of the reactor. By applying this system, the absorbed dose of mixed radiation in one of the vertical channels of a VVR-S reactor can be measured remotely and continuously without essential disturbance of the dose field of the active zone. Author

N67-28850 United Kingdom Atomic Energy Authority, Harwell (England). Analytical Sciences Div.

THE APPLICATION OF ISOTOPE DILUTION MASS SPECTROMETRY TO BURN-UP DETERMINATION. PART 1: URANIUM

E. Foster, A. J. Fudge, and C. L. Steele Feb. 1967 38 p refs

(AERE-R-5310) HMSO: 5s 6d

Isotopic dilution coupled with mass spectrometric analysis has a number of important advantages over other techniques when applied to uranium for the determination of burn-up. This report considers both the experimental and the theoretical aspects of this technique for the analysis of samples of irradiated potential nuclear fuels, and it compares results by this method with those obtained by other methods. Limitations of the isotopic dilution method due to inaccuracies in the nuclear data and to contamination from uranium are discussed. This report includes a computer program which enables the mass of uranium in the sample and the burn-up to be calculated from the isotopic ratios resulting from mass spectrometric measurements. Author

N67-28883# Authority Health and Safety Branch, United Kingdom Atomic Energy Authority, London (England).
THE GEM CODE
P. J. Hemmings 1967 109 p
(AHSB(S)-R-105) HMSO: 30s

The GEM code is a Monte Carlo neutronics code written for use on an IBM 7090 or 7094 computer. Originally written to study criticality problems it has been developed into a code versatile enough to perform calculations for a complete reactor. GEM exploits the property of the Monte Carlo method that complexities in geometry and nuclear data may be considered in as much detail as required. GEM also uses many of the techniques regarded as standard Monte Carlo, though some of them do receive a distinctive treatment here. The tracking cycle is based upon the traverse technique in which the system is divided into an inner core and a reflector by choosing a boundary across which the neutron population distribution quickly settles. GEM will handle problems with an imposed source of neutrons. Perturbations due to the addition of absorbing material can be considered using a simple form of weighted tracking. The corresponding problems for photons may also be considered. A number of auxiliary programs used in connection with GEM are also described. Principally these assist the preparation of nuclear data and other input to GEM. The concepts used in the program are described. The later chapters deal with the practical aspects of specifying and running problems, and with the contents and production of GEMDATA, a library of nuclear data sets. Author

N67-28949# Naval Research Lab., Washington, D. C.
IRRADIATION EFFECTS ON REACTOR STRUCTURAL MATERIALS Quarterly Progress Report, 1 Nov. 1966–31 Jan. 1967
J. Russell Hawthrone, Charles Z. Serpan, Jr., Henry E. Watson, and Robert A. Gray, Jr. 15 Feb. 1967 45 p refs
(NRL-Memo-1753; AD-650349) CFSTI: HC $3.00/MF $0.65

The report, covering research for the period 1 November 1966-31 January 1967, includes the following: (1) experimental A302-B steel heats insensitive to 550F irradiation, (2) radiation embrittlement of steels under cyclic versus constant temperature exposure conditions, (3) effects of applied stress during irradiation on the notch ductility of A302-B steel, (4) tensile property changes through the wall thickness of a simulated reactor pressure vessel, (5) comparison of neutron flux values for fission versus threshold-type monitors, and (6) equipment and procedures developed for elevated temperature remote tension testing of radioactive specimens. Author (TAB)

23 PHYSICS, GENERAL

Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics; 20 Meteorology; and 29 Space Radiation.

N67-27783# United Kingdom Atomic Energy Authority, Harwell (England). Electronics and Applied Physics Div.
TWO POSSIBLE USES OF AN ELECTRON-OPTICAL STRUCTURE FOR PROCESSING OPTICAL SIGNALS MODULATED AT FREQUENCIES UP TO 10^{12} CYCLES/SEC
P. Iredale Jan. 1967 9 p refs
(AERE-M-1813) CFSTI: HC $3.00/MF $0.65

A means is suggested to modulate an electron beam by sweeping it across a mask which is alternately opaque and transparent to electrons. The chopping frequency this produces can in some circumstances approach 10^{12} cycles/sec. The suggested device could be used to operate on the electron signal produced at a photocathode by a modulated light beam of small area. Hence the signal and the chopping modulations could be mixed. Thus the device would represent a frequency changer which could operate at frequencies up to 10^{12} cycles/sec. The same sweeping system is suggested as a means of performing a serial to parallel conversion with a digitally coded optical signal as input and some 60 parallel electrical outputs. Author

N67-27926# European Space Vehicle Launcher Development Organization, Paris (France). Basic Techniques Div.
ON THE USE OF CERTAIN FIRST INTEGRALS OF THEORETICAL MECHANICS IN SPACE PROBLEMS
E. Cambi May 1965 7 p refs
(ELDO-TM-F-19) CFSTI: HC $3.00/MF $0.65

Problems of theoretical mechanics likely to be encountered in the discussion of the behavior of space vehicles often show some unusual features, as compared to more conventional engineering problems. The note intends to warn the researcher of the dangers implied by a careless use of certain statements of theoretical mechanics. Author (ESRO)

N67-27950# Harry Diamond Labs., Washington, D. C.
WAVEGUIDE ANALOG OF TUNNELING THROUGH QUANTUM POTENTIAL BARRIERS
Morris Campi *In* Army Dept. Proc. of the 1966 Army Sci. Conf., Vol. I 26 Aug. 1966 p 135–148 refs (See N67-27941 15-34)
(AD-634667)

A classical analog model is investigated for particle tunneling through quantum potential barriers by using electromagnetic propagation through a section below cutoff waveguide. Equations for quantum tunneling are evolved to analyze rectangular and hyperbolic barriers for waveguide construction, and an experimental set-up is described. In effect, quantum potential barriers were simulated by a waveguide section with specific configuration, and particle tunneling was simulated by electromagnetic propagation in the waveguide. With effective barrier length of approximately 1.15 to 1.19 times the actual length, good correlation is obtained with the theory of transmission coefficient measurements for both slowly and abruptly varying potential barriers. M.W.R.

N67-27957# Ohio River Div. Labs., Cincinnati.
ULTRA HIGH VACUUM ADHESION AND FRICTION
E. Stanley Gall and John H. Hubbard *In* Army Dept. Proc. of the 1966 Army Sci. Conf., Vol. I 26 Aug. 1966 p 291–301 refs (See N67-27941 15-34)
(AD-634678)

Adhesion and friction between surfaces in ultrahigh vacuum are being measured to determine the magnitude and nature of the forces acting between the particles of a granular material such as soil. Forces between grains in a powder were found by measuring the force between a simple pair of surfaces of known gross contour in order to minimize the number of parameters. Magnitude, range, and dependence on surface cleanliness exhibited by the forces were used to evaluate the various mechanisms proposed to account for adhesion forces. For load smaller than 4,000 grams, no adhesion was observed, which may indicate load dependency of adhesion. Dependence of observed adhesion on surface cleanliness indicates that the forces, extremely short in range are considered to be either/or a combination of London-van der Waals forces and metallic bond forces. Increase in friction in ultrahigh vacuum is probably due to cleaning of the surfaces as wear proceeds rather than to roughening of the surfaces. M.W.R.

N67-27974# Army Engineer Waterways Experiment Station, Vicksburg, Miss. Mobility and Environmental Div.
DEVELOPMENT OF A FORMULA FOR TOWING RESISTANCE FOR A WHEEL IN SOFT SOIL
John L. McRae *In* Army Dept. Proc. of the 1966 Army Sci. Conf., Vol. II 26 Aug. 1966 p 77–89 refs (See N67-27971 15-34)
(AD-634622)

A formula for towing resistance to a wheel in soft soil was developed by using dimensional analysis to find the resistance formula for a rigid wheel being towed in a homogeneous, yielding medium that incorporated length, time, and mass. Introduction of shifting phenomena into the solution for rigid wheels, and subsequent empirical correlations for a pneumatic tire then gave an exact configuration as function of tire deflection, chord length, and depth of sinkage. Correlation with extensive test results on pneumatic tire sizes, wheel loads, and degrees of tire reflection in cohesionless desert sand and in cohesive buckshot clay gave the empirical formula $P_t=3(Wz/l)^{0.8}$ where P_t is the towing force, W the vertical load, z represents sinkage, and l is the distance from point of contact with soil of front of wheel to a point directly behind the axle. G.G.

N67-27978# Army Engineer Research and Development Labs., Fort Belvoir, Va. Night Vision Lab.
INFLUENCE OF ELECTROMAGNETIC FIELDS ON LIQUID CRYSTALS
John H. Muller *In* Army Dept. Proc. of the 1966 Army Sci. Conf., Vol. II 26 Aug. 1966 p 141–155 refs (See N67-27971 15-34)
(AD-634627)

A cholesteric liquid crystal was sandwiched between electrodes and placed under a polarizing microscope that photographed only light returned from the sample after passing through the analyzer. An oscilloscope connected to a photomultiplier measured light intensity. It was found that a steady d.c. field produced increased reflection from the sample; reversing or cycling of the field did not decrease the brightness below that of case four. Alternating electric fields also produced a brightness below that of case four. Alternating electric fields also produced a brightness increase and showed a temperature-dependent relaxation time for the appearance of new dynamics at field reversal. It was concluded that electric fields rapidly changed the plane structure of the cholesteric mesophase by rapid orientation and alignment of molecules. However, a long range molecular order persisted in the mesophase of cholesteryl nonanoate despite intense electrical fields. G.G.

N67-27981# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
WATER SHOCK WAVES FROM ABOVE-WATER EXPLOSIONS
J. M. Pinkston, Jr. and Akira Sakurai *In* Army Dept. Proc. of the 1966 Army Sci. Conf., Vol. II 26 Aug. 1966 p 199–213 refs (See N67-27971 15-34)
(AD-634531)

Experimental and theoretical studies were performed to provide quantitative information on induced water shock from above water explosions and to derive general formulas for computing the underwater pressure. Free-air pressure-time data were used to define the water surface loading mechanism so that nonlinear characteristics of the airblast could be included. The acoustic theory was used to describe water shock induced by a generating source high above the surface, and the time-pressure history at spatial positions under water covered conditions where the generating source was closer to the water surface and the resulting disturbance field in the water was of finite amplitude. Results indicated that the acoustic theory completely described pressures in water with exception of the near zero point. In the vicinity of the zero point, the finite disturbance effect in water is essential for underwater pressure determination. G.G.

N67-27986# Army Research Office, Durham, N. C.
ON A RELATIONSHIP BETWEEN THE ERRORS OF POSITION, VELOCITY AND ACCELERATION
Theodor W. Schmidt *In* Army Dept. Proc. of the 1966 Army Sci. Conf., Vol. II 26 Aug. 1966 p 301–307 refs (See N67-27971 15-34)
(AD-634638)

The best estimates for position, velocity, and acceleration in flight testing are obtained for each point of the trajectory moving polynomial arc smoothing. This fitting procedure by the method of least squares a polynomial of the degree k over N consecutive points by taking the value at midpoint of the polynomial, together with first and second derivatives at the same point, as best estimates for position, velocity, and acceleration. The procedure is repeated by deleting the first point and adding the point N+1 until the requested part of the trajectory is covered. Results for a calculation on the decision quotient "Q" are given for the case where Q(N,k) depends on the degree k of the polynomial for the cases of N=15 and 101 points. If the required precision in position, velocity, and acceleration results in a Q value of the order one, then these precision requirements can be fulfilled by instrumentation based on position determination; if the Q value required is essentially different from one, then auxiliary measuring systems must be utilized. G.G.

N67-27993# Springfield Armory, Mass.
ACOUSTICAL AND VISUAL ATTENUATION THROUGH DYNAMIC REGULATION OF MUZZLE GAS FLOW
Wayne H. Watling *In* Army Dept. Proc. of the 1966 Army Sci. Conf., Vol. II 26 Aug. 1966 p 449–463 refs (See N67-27971 15-34)
(AD-634649)

The use of weapon muzzle attachments for flash and sound suppression was studied by evaluating the fundamental concepts of fluid flow and methods of high velocity gas control. A test fixture consisting of a slotted sleeve to accommodate several insets was tried on the M73 machine gun with a variety of insert configurations. A divergent–convergent–divergent flow passage which also performed a booster function with various flow sections between the barrel exit and the outer divergent section, provided a top performance index for the number of rounds fired and flashes observed per minute; sound suppression was also obtained to a certain extent by the convergent–divergent passage; but a nozzle unit with absorbent material proved more effective acoustically. G.G.

N67-28050# New York Univ., N. Y.
LOW TEMPERATURE PROPERTIES OF LIQUID He^3
A. E. Glassgold *In* Brookhaven Natl. Lab. Symp. on Inelastic Scattering of Neutrons by Condensed Systems Mar. 1966 p 69–77 refs (See N67-28041 15-24)

Considered are simple theoretical concepts and current experimental results on the properties of liquid helium-3 at low temperatures and low pressures. Some of the topics to be covered are (1) the extent of experimental confirmation of Landau's theory of the Fermi liquid; (2) the possible transition into a superfluid phase; (3) the observation of zero-sound; and (4) the importance, and present difficulties, in "microscopic" probing of the elementary excitations. Author

N67-28066# State Univ. of New York at Buffalo.
THE DISPERSION RELATION IN LIQUID HELIUM
Lyle B. Borst *In* Brookhaven Natl. Lab. Symp. on Inelastic Scattering of Neutrons by Condensed Systems Mar. 1966 p 173–174 ref (See N67-28041 15-24)

The normal mode description of the excitations in liquid helium gives a complete description of the thermodynamic properties. In

this representation the normal modes are among a set of diatomic rotors with nearest-neighbor spacings. The ground state (Debye liquid) is a substrate in which the excitations appear as a distinguishable component. The lambda point is the temperature at which no molecules remain in the ground state. In the dispersion relation the lambda point is related to the minimum by the equality $kT_\lambda = c_2 p_0$. Beyond p_0 only phonons are excited, since the diatomic systems have dissociated. The dispersion curve below p_0 represents initially phonon excitations supplemented by normal mode excitations among the diatomic rotors. Author

N67-28096# Air Force Systems Command, Wright-Patterson AFB, Ohio. Research and Technology Div.

ROUND ROBIN MEASUREMENTS ON A MAGNETO-DIELECTRIC MATERIAL AT MICROWAVE FREQUENCIES

Robert M. Van Vliet Nov. 1966 43 p refs

(AFML-TR-66-328; AD-649551) CFSTI: HC $3.00/MF $0.65

A microwave measurements round robin was conducted with eight industrial and governmental laboratories using a moderately lossy magneto-dielectric material consisting of a nickel ferrite (38.80 mol % Ni, 0.50 mol % Co) dispersion in polystyrene. The round robin material was prepared by hot compression molding using pressures up to 9000 psi to assure sample uniformity. Identical discs were furnished to each laboratory for measurements from 500 to 2000 MHz using their normal measurement techniques. Several laboratories submitted data in addition to that requested including the effect of sample thickness and certain other variables. The results are presented graphically and with limited statistical analysis. The standard deviation in percent of average value varied over the following range: permeability, mu'–2.5 to 7.5 percent; mu double prime–13 to 25 percent permittivity, epsilon'–3.2 to 7.9 percent, epsilon double prime–11 to 32 percent. Data analysis failed to show any specific causes of the data dispersion. Random errors from unknown causes overshadow any procedural, equipment of material variations reported by the participating laboratories. Author (TAB)

N67-28149 Joint Publications Research Service, Washington, D. C.

ENERGY CHARACTERISTICS OF A FIELD SCATTERED BY A CONVEX BROKEN SURFACE

Ye. V. Chayevskiy *In its* Studies in Radio Wave Propagation 4 May 1967 p 124–138 refs (See N67-28141 15-07)

The energy characteristics of a scattered field are calculated for convex uneven surfaces of arbitrary shape with arbitrary shape of the incident wave. It is shown that for irregularities which are high by comparison with the length of the incident wave the Kirchhoff approximation coincides with the beam approximation proposed by V. A. Foch. This situation permits a simple, clear picture of energy scattering by a rough body to be given. With the help of the beam model some qualitatively new results are obtained. In particular, for closed bodies with high irregularities the statistical corrections are calculated for the reflection formulae of V.A. Foch. Author

N67-28241# Wisconsin Univ., Madison. Mathematics Research Center.

STEADY-STATE WAVE PROPAGATION IN HOMOGENEOUS ANISOTROPIC MEDIA

Calvin H. Wilcox Nov. 1966 70 p refs

(Contract DA-31-124-ARO(D)-462)

(MRC-TSR-702; AD-649091) CFSTI: HC $3.00/MF $0.65

The paper discusses the Greens matrix G(x, zeta) for steady-state wave propagation in homogeneous anisotropic media. Explicit representations of G(x, zeta) are derived for dissipative media (Im zeta > 0), loss-less media (Im zeta = 0) and for the far-field (absolute value of x approaches infinity). Author (TAB)

N67-28249# Wisconsin Univ., Madison. Mathematics Research Center.

HIGH-FREQUENCY DIFFRACTION OF THE RADIATION FROM A NEARBY SOURCE

D. S. Jones Nov. 1966 28 p refs

(Contract DA-31-124-ARO(D)-462)

(MRC-TSR-706; AD-649093) CFSTI: HC $3.00/MF $0.65

An approximate formula is found for the field produced on the boundary of an obstacle in an inhomogeneous medium by a source which is close to the boundary. Both harmonic and aperiodic waves are discussed. Author (TAB)

N67-28277# IIT Research Inst., Chicago, Ill. Technology Center.

CONTINUOUS FACSIMILE SCANNER EMPLOYING FIBER OPTICS Quarterly Report, 1 Oct.–31 Dec. 1966

Donald A. Ponterelli Mar. 1967 13 p (Contract DA-28-043-AMC-00164(E))

(IITRI-A6093-30; QR-10; ECOM-00164-10; AD-649185) CFSTI: HC $3.00/MF $0.65

The basic mechanical system was fabricated and assembled. The temperature drift previously causing difficulty in the low-level modulator was substantially reduced. Preliminary design of the 18-5/8 inch facsimile transmitter was initiated and a fiber optics array configuration is presented. Author (TAB)

N67-28317# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.

CONSERVATION OF AN ION BEAM BRIGHTNESS. STUDY OF A NON BRIGHTNESS DISTURBING LENS [CONSERVATION DE LA BRILLANCE D'UN FAISCEAU IONIQUE. ETUDE E'UNE LENTILLE NE DETERIORANT PAS CETTE BRILLANCE]

Pierre Bernard Nov. 1966 106 p refs In FRENCH

(CEA-R-3068)

Previous studies have shown that very great brightness can be obtained if the extraction and focusing systems are conceived so that they carry no aberrations. This concept was used in the design of a lens system that would not disturb the brightness of an ion beam. The principal elements of the assembly are described with emphasis on the elements essential for success. The experimental results obtained show that the methods of calculation used and the concept of linearity make it possible to define and construct a lens focusing a high intensity beam without multiple loss of brightness. NSA

N67-28333# Utah State Univ., Logan. Electro-Dynamics Labs.

NUMERICAL RESTORATION OF OPTICAL OBJECTS OBSCURED BY DIFFRACTION AND NOISE

Richard W. Harris and Craig K. Rushforth 31 Dec. 1966 232 p refs

(Contract AF 19(628)-3825; ARPA Order 450)

(AFCRL-67-0070; SR-8; AD-649261) CFSTI: HC $3.00/MF $0.65

The problem considered is the restoration of incoherent optical objects which have been diffracted by an optical system and corrupted by detector and additive background noise. The approach in solving the problem is basically numerical and considers operating directly on the image and point spread function rather than the Fourier transform of these quantities. Special emphasis is placed on studying the effects of noise and the use of a priori information in the restoration process. Several 'optimum' estimates of the object intensity distribution are considered. Based substantially on statistics which have been verified in practice, the Baye's, maximum a posteriori, maximum likelihood and mean square error estimates of the object intensity distribution are obtained. These statistical estimates are compared mathematically and in many cases numerically to other non-statistical estimates formulated from

control theory and dynamic programming. Extensive numerical results have been obtained for the restoration of various one-dimensional objects in the presence of noise. Two monochromatic 'point sources' in the presence of noise are shown to be resolved when separated by 1/5 of the Rayleigh criterion distance. Numerical results are also shown for the mean square error as a function of a priori information, the measuring scheme chosen, and diffraction. Author (TAB)

N67-28356# Technisch Documentatie en Informatie Centrum voor de Krijgsmacht. The Hague (Netherlands).
INFRARED: AN ANNOTATED BIBLIOGRAPHY UP TO 1966
H. Lieffering, comp. Mar. 1966 160 p
(TDCK-44741) CFSTI: HC $3.00/MF $0.65

Included are abstracts of 426 papers on various aspects of infrared radiation. Nine chapters are arranged as follows: general, emission, transmission, detection, noise, systems, applications, miscellaneous, and bibliographies. NSA

N67-28373*# Measurement Analysis Corp., Los Angeles Calif.
TECHNIQUES AND ERRORS IN MEASURING CROSS-CORRELATION AND CROSS-SPECTRAL DENSITY FUNCTIONS
R. D. Kelly, L. D. Enochson, and L. A. Rondinelli [1966] 214 p refs
(Contract NAS8-20179)
(NASA-CR-74505) CFSTI: HC $3.00/MF $0.65 CSCL 09D

Analog, digital and hybrid data reduction techniques presently in use are described. In addition, those techniques used in the radar and communication fields that appear useful for the specific application of interest (dynamic pressure measurements) are detailed. The error formulas cover both statistical uncertainty errors from the analysis of records with finite bandwidth and finite duration, and hardware related errors. Particular emphasis is placed on phase errors throughout the entire measuring system from the transducer through the analyzer. Both static and dynamic phase errors are covered. In addition, errors from analyzer parameters (filter bandwidth, scan rate, etc.), extraneous additive noise, finite transducer size and magnetic tape recorder velocity nonuniformities are discussed. Author

N67-28375*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
EDGE DIFFRACTION FROM TRUNCATED PARABOLOIDS AND HYPERBOLOIDS
W. V. T. Rusch 1 Jun. 1967 18 p
(Contract NAS7-100)
(NASA-CR-84787; JPL-TR-32-1113) CFSTI: HC $3.00/MF $0.65 CSCL 20F

The geometrical theory of edge diffraction is applied to the problem of scattering from both paraboloidal and hyperboloidal reflectors. The results are compared with classical results from geometrical optics and vector diffraction theory. It is found that the edge-diffracted field provides an excellent approximation to the rigorously determined field except in certain regions such as shadow–light boundaries. Author

N67-28381# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A PROBLEM IN THE EXTRACTION OF EFFECTIVE SIGNAL IN THE PRESENCE OF HIGH-INTENSITY NOISE
S. K. Ismatkhodzhayev 20 Dec. 1966 22 p refs Transl. into ENGLISH from Izv. Akad. Nauk Uz. SSR, Ser. Tekhn. Nauk (Tashkent), no. 2, 1964 p 14–26
(FTD-TT-65-1075; TT-67-61331; AD-649032) CFSTI: HC $3.00/MF $0.65

The proposed solution to the problem is automating the processing of gravimetric information by converting the continuous signals of gravimetric information into a digital code and using computers as digital filters. Some simple methods for processing gravimetric information obtained from observations with surface ships and airplanes are discussed and the parameters of digital filters are determined on the basis of the least mean square error as a criterion. Formulas are given for determining the correlation function of gravimetric recordings (computed on a Ural-1 computer), and the parameters of the correlation functions for shipboard and aerial measurements of the force of gravity g are given in two tables. The computations show that the dispersion of the vertical component of acceleration of the ship in high waves is on the same order as the dispersion of the same component for an airplane and when waves are quiet, two to three orders lower. Gravimeter recordings include noise whose frequency is in the 0.3-1.18 and 0.04-2.1 rad/sec ranges for observations from surface ships and airplanes, respectively. The principal energy is concentrated near the fundamental frequencies of the base, which average about 1.1 rad/sec for fundamental ship vibrations and 10-14 times higher than the fundamental frequency of an airplane-autopilot system (about 0.09 rad/sec). Author (TAB)

N67-28433# Commissariat a l'Energie Atomique, Saclay (France).
STUDIES OF POTENTIAL DIFFERENCES RESULTING FROM INJECTION OF ELECTRONEGATIVE GASES INTO A FLAME
Jean Debiesse, Siegfried Klein, and Pierre Kraus 1965 5 p refs Transl. into ENGLISH from Compt. Rend. (Paris), v. 260, 11 Jan. 1965 p 465–467
(BNL-TR-27)

Two identical electrodes at the same temperature were thrust into a flame, and a potential difference was created between them by injection of an electronegative gas on one of them. This potential difference is a function of the temperature of the electrodes and of the nature of the injected gas. The possibility of obtaining an alternating potential difference was also shown. Author (NSA)

N67-28446# Melpar, Inc., Falls Church, Va.
RESEARCH IN MEASUREMENT OF DIELECTRIC PROPERTIES OF MATERIALS TO EXTREME TEMPERATURES Final Report
R. W. Stowe and W. T. Townsend Nov. 1966 47 p refs
Prepared for Sandia Corp., Albuquerque, N. Mex.
(Contract AT(29-1)-789)
(TID-23684) CFSTI: HC $3.00/MF $0.65

A research and development effort to extend the temperature range of dielectric measurements of refractory dielectric materials beyond 1650°C is described. VSWR measurements in a shorted coaxial line were selected as the most promising method, eventually supplemented by techniques of time domain reflectometry. A special high temperature vacuum furnace and several experimental coaxial line assemblies were designed and constructed. Above 1700°C, severe difficulties were encountered as a result of unsuppressed thermionic emission from the walls of the coax line, causing significant impedance variations, and preventing dielectric measurements. The nature of the interaction between the emission and the measurement system was investigated. Author (NSA)

N67-28639# General Electric Co., Philadelphia, Pa. Missile and Space Div.
SYMPOSIUM ON INTERDISCIPLINARY ASPECTS OF RADIATIVE ENERGY TRANSFER Final Report, 15 Aug. 1965–31 Mar. 1967

Sinclaire M. Scala and Richard N. Thomas 1 Apr. 1967 81 p refs Symp. held at Philadelphia, 24–26 Feb. 1966
(Contract Nonr-5035(00))
(Doc.-67SD5223; AD-651048) CFSTI: HC $3.00/MF $0.65

Summaries are given of the papers presented at the symposium. The topics cover radiative energy transfer with respect to space and atmospheric physics, aerospace applications, stellar aerodynamics, oceanography, solid transparent media, plasma, shock waves. Author (TAB)

N67-28702# Linde A. G., Hollriegelskreuth (West Germany).
LOW-TEMPERATURE TECHNIQUES AND AERONAUTICS [TIEFTEMPERATURTECHNIK UND RAUMFAHRT]
W. Baldus [1966] 7 p In GERMAN; ENGLISH summary Presented at the Ann. Joint Meeting DGRR/WGLR, Bad Godesberg, W. Germany, Oct. 1966
(DGRR/WGLR Paper-66-042) CFSTI: HC $3.00/MF $0.65

Examples for space problems are given when a low temperature technique is involved. In this connection, special low temperature plants for space simulation purposes are mentioned as well as shrouds which must meet typical conditions as to design, vacuum, and radiation. Low temperature technique is also used for rocket test facilities, and especially for the supply of propellants and oxidizers (e.g. liquid hydrogen, liquid oxygen). Some typical low temperature plants, already manufactured, are mentioned and a brief outlook is given of development tendencies in the future. Author (ESRO)

N67-28715# Army Materials Research Agency, Watertown, Mass.
THE INTERRELATION OF THE THERMOPHYSICAL PROPERTIES OF SILVER
Albert F. Grenis Jan. 1967 23 p refs
(AMRA-TR-67-02; AD-649515) CFSTI: HC $3.00/MF $0.65

An analytical study was made of the interrelation of thermal, optical, and electrical properties of materials. The study was concerned with a review of the basic physical equations pertaining to the properties of emissivity, refractive index, and absorption coefficient; a review of the interrelation of these properties with electric conductivity and electric permittivity; and the use of equations with extrapolation techniques to calculate additional data. The equations and methods, together with the data available in the technical literature for the noble metal silver, were then applied to determine emissivity over a broad range of frequencies and temperatures. Author (TAB)

N67-28745*# Stanford Univ., Calif. Microwave Lab.
ONE AND TWO-DIMENSIONAL STEADY STATE LOW PRESSURE DISCHARGE THEORY Summary Report II
E. K. Shaw [1967] 91 p refs
(Contract NAS3-4100)
(NASA-CR-54665; ML-1495) CSCL 20I

A pressure theory approach, modified to take into account ion generation, is used to describe dc discharges in the low- and medium-pressure regimes. This theory uses the "moment method" of solution of the Boltzmann equation to obtain differential equations which describe low pressure discharges in terms of measurable macroscopic parameters. Solutions are found for the parameters of the discharges in one-dimensional planar, cylindrical, and coaxial geometries for various generation rates and including both the effects of ion-neutral collisions and an applied magnetic field. The results agree with the more exact formulation of Langmuir. In the limit of a small inner conductor, the one-dimensional coaxial solutions are used to determine the properties of cylindrical Langmuir probes in the ion collection regime. The results agree with present collisionless probe theories. The solutions are extended to include the effects of collisions and an applied magnetic field on the characteristics of a cylindrical probe. For ion generation proportional to electron density, two-dimensional solutions are found for the parameters of the discharges in a rectangular box, a finite length cylinder, and between finite length concentric coaxial cylinders. Author

N67-28868# Honeywell, Inc., Minneapolis, Minn. Military Products Group.
TWO PARTICULAR SOLUTIONS OF THE PROBLEM ON THE MOTION OF A BODY WITH A STATIONARY POINT
P. V. Kharlamov [1964] 6 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSR, Ser. Mekhan. (USSR), v. 154, no. 2, 1964 p 287–289
(TRANS-512) CFSTI: HC $3.00/MF $0.65

Two solutions are presented for the problem of the motion of a body with one fixed point. Author

N67-28945# Illinois Univ., Urbana. Antenna Lab.
THEORY OF PARTIAL COHERENCE—A REVIEW
D. S. Karjala and R. Mittra Feb. 1967 50 p *Its* Antenna Lab. Rept. No. 67-1
(Contract AF 19(628)-3819)
(TR-11; AFCRL-67-0192; AD-651068) CFSTI: HC $3.00/MF $0.65

The report reviews the subject of partial coherence, mainly with respect to the classical second-order theory. The primary sources on this subject are Born and Wolf (1964), Mandel and Wolf (1965) and Beran and Parrent (1964). The material contained in these references is used freely herein. Author (TAB)

24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR

Includes atomic, molecular, and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

N67-27785 European Atomic Energy Community, Brussels (Belgium). Radioisotopes Group.
PRACTICAL ASPECTS OF ACTIVATION ANALYSIS WITH CHARGED PARTICLES
Dec. 1966 165 p refs Proc. of Meeting held at Grenoble, France, 23 Jun. 1965
(EUR-2957.e) Available from Office Central de Vente des Publ. des Communautes Europeennes, Luxembourg: 19.50 FF

These proceedings relate to the discussions which took place at the Grenoble Center on June 23, 1965 concerning the chief practical problems encountered by specialists in charged-particle activation analysis. Author

N67-27808 International Centre for Theoretical Physics, Trieste (Italy).
A NOTE ON THE THREE-BODY TREATMENT FOR RE-ARRANGEMENT COLLISIONS
A. Y. Abul-Magd (Intern. Atomic Energy Estab., Cairo) Intern. Atomic Energy Agency, Mar. 1967 9 p refs Submitted for publication
(IC-67-15) CFSTI: HC $3.00/MF $0.65

Faddeev's theory, developed for the study of three-body scattering problems and based on the representation of the three-body wave function as a superposition of three terms, being the solution of a linked set of equations, is used here to calculate the transition amplitude for a rearrangement collision. Iteration method is applied to solve the system of coupled equations. ESRO

N67-27811 Tokyo Univ. of Education (Japan). Dept. of Physics
DERIVATION OF THE OREAR'S FORMULA FROM THE REGGE THEORY AND THE UNITARY
Tetsuo Sawada [1967] 12 p refs
(TUEP-67-8) CFSTI: HC $3.00/MF $0.65

The restriction of the unitarity condition on the Regge trajectory is examined. The functional form of $\alpha(t)$ is compared with the Orear's experimental formula of the elastic high energy scattering. Author

N67-27817 Tokyo Univ. of Education (Japan). Dept. of Physics
K^--CAPTURE BY He^4 AND K^-–N–S-INTERACTION
Toshitake Kohmura [1967] 12 p refs
(TUEP-67-10) CFSTI: HC $3.00/MF $0.65

The K^--capture rate by He^4 is calculated by using K^--N s-interaction. Antisymmetrization of nuclear wave functions is considered. The obtained capture rate from the 2p-orbit is $2.4 \pm 0.4 \times 10^{13}$ sec^{-1}, which is consistent with its experimental value. Hyperon produced by K^--capture from the 2p-orbit is, however, emitted from nucleus. Production of hypernuclei He^4 and H^4 results from the capture of K^--meson in the 1s-orbit. Our calculation also shows that the hypernucleus production processes are 2.8% of all K^--capture events. Agreement of these results with the experiment shows that K–N s-interaction is effective even in K^--capture by nucleus. Author

N67-27855 Aktiebolaget Atomenergi, Stockholm (Sweden).
AN OPTICAL MODEL STUDY OF NEUTRONS ELASTICALLY SCATTERED BY IRON, NICKEL, COBALT, COPPER, AND INDIUM IN THE ENERGY REGION 1.5 TO 7.0 MeV
B. Holmqvist and T. Wiedling Mar. 1967 21 p refs
(AE-270)

Angular distributions of elastically scattered neutrons have been measured for cobalt and copper at nine energies between 1.5 and 7.0 MeV, for natural iron at 4.6 MeV, for natural nickel and indium at four energies between 3.0 and 4.6 MeV, by using time-of-flight technique. The observed angular distributions were corrected for neutron flux attenuation, multiple elastic scattering, and the finite geometry of the source-sample-detector system by using a Monte Carlo program. Theoretical angular distributions have been fitted to the experimental angular distributions by using an optical modal potential with Saxon–Woods form factors. A computer program was used to find parameter values of the potential giving the best fittings to the experimental angular distributions. Author

N67-27864 United Kingdom Atomic Energy Authority, Harwell (England). Research Group.
SCATTERING LAW $S(\alpha,\beta)$-VALUES FOR HEAVY WATER AT 540°K
D. I. Page Feb. 1967 24 p refs
(AERE-R-5408) HMSO: 3s 6d

The differential scattering cross sections of D_2O at 540°K have been measured for neutrons of 0.055 eV and 0.107 eV incident energy. The results are given as tables of scattering law $S(\alpha,\beta)$-values derived directly from the experimental data. The values cover ranges of energy and momentum transfers of 0–0.19 eV and 1–18 Å^{-1} respectively. Author

N67-27867# Imperial Coll. of Science and Technology, London (England).
SYMMETRY CONCEPTS IN MODERN PHYSICS
Abdus Salam 1966 62 p ref

Basic concepts of modern physics are reviewed, and theories pertaining to elementary particles, and their interactions and interrelations are described. The contributions made by Dirac and Yukawa are enumerated in relation to the development of quantum theory. Mesons and the symmetries of the nuclear force are discussed. Synthesis achieved in regard to the symmetries of the nuclear force is surveyed, and consideration is given to the gravitation force and the so-called weak force. L.E.W.

N67-27876 Polish Academy of Sciences, Cracow. Inst. of Nuclear Physics.
DYNAMICAL AND THERMODYNAMICAL STRUCTURE OF WATER FROM THE SCATTERING OF COLD NEUTRONS [DYNAMICZNA I TERMODYNAMICZNA STRUKTURA WODY NA PODSTAWIE ROZPRASZANIA ZIMNYCH NEUTRONOW]
Antoni Szkatula and Andrzej Fulinski Dec. 1966 29 p refs Submitted for publication
(INP-501/PS)

The possibility of determining the structure parameters of liquid water from cold neutron scattering data is discussed. It was found that in this way the dynamical and associational parts of the thermodynamic functions, especially of the heat capacity C_v, can be measured, which permits the calculation of the fraction of hydrogen bonds still existing in water, and of their energy. A method is proposed for determining the true frequency spectrum, and the so-called polarization factors of water, from the scattering of cold neutrons by light and heavy water and ice. Some steps are illustrated on the basis of currently available neutron data, e.g., the associational part of C_v of water is estimated to be about 7.3 cal/mole degree at 0°C. The design of a complete neutron experiment for determining the true frequency spectrum, and then of the structure and thermodynamic parameters of water, is included. Author

N67-27877 Polish Academy of Sciences, Cracow. Inst. of Nuclear Physics.
ELASTIC SCATTERING OF VERY HIGH ENERGY PARTICLES FROM NUCLEI [ELASTICZNE ROZPRASZANIE CZASTEK BARDZO WYSOKICH ENERGII NA JADRACH ATOMOWYCH]
Wieslaw Czyz and Leonard Lesniak Jan. 1967 13 p refs Submitted for publication
(NP-526/PL)

This note contains results of calculations of the elastic scattering cross sections of high energy nucleons scattered from nuclei, presents numerical results for ^{4}He target nucleus, and compares them with the recent experimental data. Author

N67-27913# Brookhaven National Lab., Upton, N. Y.
DIGITIZED SPARK CHAMBERS IN HIGH ENERGY PHYSICS
Joachim Fischer [1967] 63 p refs Presented at Intern. Conf. on Electromagnetic Interactions at Low and Intermediate Energies, Dubna, USSR
(Contract AT(30-2)-GEN-16)
(BNL-11031; CONF-670203-1) CFSTI: HC $3.00/MF $0.65

The properties of digitized wire spark chamber systems are compared to alternative techniques for track determination. Their advantages have led to a rapid increase in their application to high energy physics experiments. The characteristics of spark chamber planes and the problems associated with multiple tracks are briefly described. Factors affecting spatial resolution are discussed and results with various readout systems are compared. The angular and momentum resolution in chamber arrays attainable in experiments is presented, including the operation of spark chambers at 1/10 atmospheric pressure for the reduction of multiple scattering in the system. The contemporary use of digitized spark chambers in high energy physics is illustrated with a list of over 40 experiments, many of them with a tentative layout and some system details. The advantageous employment of digitized spark chambers to particular experiments now and proposed is described. Author (NSA)

N67-27922# International Centre for Theoretical Physics, Trieste (Italy).
THE INTERNATIONAL CENTRE FOR THEORETICAL PHYSICS Annual Report, 1965–1966
Dec. 1966 24 p refs
(AR-2) CFSTI: HC $3.00/MF $0.65

The principal purpose of the International Centre for Theoretical Physics is reviewed. The Centre will accordingly have four functions a) to train fellows from developing countries, b) to help in fostering the growth of advanced level studies in theoretical physics in the developing countries, c) to conduct through its professors visiting and guest scientists and fellows, research in theoretical physics on a broad basis, and d) to provide an international forum for personal contacts vital to research in theoretical physics. Author

N67-27944# Picatinny Arsenal, Dover, N. J. Explosives Lab.
STUDY OF LOW FREQUENCY MOLECULAR MOTIONS IN EXPLOSIVES BY SLOW NEUTRON INELASTIC SCATTERING
Henri P. Boutin, Henry J. Prask, and Samuel Trevino *In* Army Dept. Proc. of the 1966 Army Sci. Conf., Vol. I 26 Aug. 1966 p 49–62 refs (See N67-27941 15-34)
(AD-634661)

Inelastic scattering of neutrons is used to study the nature of molecular motions in explosives, as well as the correlation of molecular dynamics with thermodynamic quantities and other macroscopic properties. Explosive sensitivity and internal energy have been tentatively correlated for lead styphnate, HMX, RDX, and picric acid. Picric acid shows the greatest and beta-HMX the slowest rate of change near room temperature. Results of this study stress the importance of understanding the microscopic behavior of compounds in order to predict their explosive characteristics. M.W.R.

N67-27983# Army Missile Command, Huntsville, Ala.
THE SELF-FOCUSING OF INTENSE BEAMS OF RELATIVISTIC-ELECTRONS
T. G. Roberts *In* Army Dept. Proc. of the 1966 Army Sci. Conf., Vol. II 26 Aug. 1966 p 245–258 refs (See N67-27971 15-34)
(AD-634634)

A 30,000 ampere, 30 nanosec pulse of 3 MeV electrons was injected into an ionized medium with high charge particle density. The beam was intercepted at various distances from the injection point and its dynamics were deduced from the nature of damages produced at interception. Two time integrated photographs made when both the X-ray machine and the linear pinch were fired showed that the beam of relativistic electrons can be extracted from the electrode space of the X-ray machine, and that these electrons form a pinch when they enter an ionized medium. This pinched beam of electrons traveled more than 23 centimeters without blowing up, while an electron beam projected into the vacuum blew up in less than 2 centimeters. G.G.

N67-28041# Brookhaven National Lab., Upton, N. Y.
SYMPOSIUM ON INELASTIC SCATTERING OF NEUTRONS BY CONDENSED SYSTEMS
Mar. 1966 235 p refs Symp. held at Upton, N. Y., 20–22 Sep. 1965 Supported by AEC
(BNL-940(C-45)) CFSTI: HC $3.00/MF $0.65

In the conference papers presented, attention is focused on accomplishments in broad areas of experimental and theoretical activities, and the objectives which might be realized with more powerful neutron sources. For individual titles, see N67-28042 through N67-28069.

N67-28044# Brookhaven National Lab., Upton, N. Y.
LIQUIDS
G. H. Vineyard *In its* Symp. on Inelastic Scattering of Neutrons by Condensed Systems Mar. 1966 p 16–22 (See N67-28041 15-24)

Current understanding of the atomic structure and atomic dynamics of simple liquids are reviewed. In the past decade the theory of transport coefficients and of scattering processes has been improved by the introduction of time-displaced correlation functions. Results are mainly formal, however, and specific calculations still depend on models, a great many of which have been proposed. Another major advance has come recently from computer "experiments" on classical fluids. The interrelation of these methods with neutron scattering is discussed. Author

N67-28054# General Dynamics Corp., San Diego, Calif.
INELASTIC SCATTERING OF NEUTRONS BY REACTOR TYPE GRAPHITE
W. L. Whittemore *In* Brookhaven Natl. Lab. Symp. on Inelastic Scattering of Neutrons by Condensed Systems Mar. 1966 p 94–95 refs (See N67-28041 15-24)

The neutron velocity selector was used to study the scattering of monoenergetic neutrons in the energy range 0.17 to 0.30 eV by a thin layer of reactor grade graphite. This measurement differs from previous ones in the use of higher energy incident neutrons which can excite directly the crystal energy levels. Egelstaff and Harris, using cold neutrons, found energy levels at 0.08, 0.12, and ≈0.18 eV. Their 0.12-eV level is in disagreement with the level 0.108 eV predicted by Young and Koppel. The present data give energy levels at 0.055, 0.08, and 0.12 eV, and a broader level in the range 0.16 to 0.20 eV, in agreement with the predictions of Young and Koppel except for the 0.12-eV level. Data confirm the 0.12-eV level reported by Egelstaff. The effect of coherent scattering to alter peaks in the scattering cross section is believed not to be significant. It appears that some of the force constants of Young and Koppel should be altered (consistent with the correct specific heat) to shift their level from ≈0.108 to 0.12 eV. Author

N67-28055# Battelle Memorial Inst., Columbus, Ohio.
A MULTIPHONON NEUTRON SCATTERING STUDY OF HYDROGEN BONDING IN ZIRCONIUM HYDRIDE
O. K. Harling and B. R. Leonard, Jr. *In* Brookhaven Natl. Lab. Symp. on Inelastic Scattering of Neutrons by Condensed Systems Mar. 1966 p 96–104 refs (See N67-28041 15-24)
(Contract AT(45-1)-1830)

The Battelle rotating-crystal spectrometer has been used to investigate the hydrogen bonding in a sample of ZrH. Scattered neutron spectra were obtained at scattering angles of 15° to 165° for incident energies of 0.504, 0.386, and 0.180 eV. The over-all resolution on energy changes was from 4% to about 20% for neutrons scattered from the first three vibration levels. The observed energies and widths of the first three levels were found to be 141.4±3, 280.9±8,411±9, and 26.4±0.6, 52.2±3.7, 72±6 meV, respectively. Resolution corrections have been applied to these energy widths. The angular distributions of elastic scattering and of the inelastic scattering from the first three vibration levels were compared with theory, assuming that the hydrogen atom is bound in an isotropic harmonic potential well. The experimental elastic scattering distributions agreed with theory to within ±1% to ±6%. For all incident energies the angular dependence of the total scattering associated with each vibrational level agreed with theory to from ±9% or ±23%. On the basis of these results it appears that the assumption of harmonic bonding for the first three levels in ZrH is a good first approximation. Author

N67-28056# European Atomic Energy Community, Ispra (Italy). Reactor Physics Dept.
HYDROGEN MOTION IN PRIMARY SOLUTIONS OF HYDROGEN IN SOME TRANSITION ELEMENTS
W. Kley, J. Peretti, R. Rubin, and G. Verdan *In* Brookhaven Natl. Lab. Symp. on Inelastic Scattering of Neutrons by Condensed Systems Mar. 1966 p 105–125 refs (See N67-28041 15-24)

The scattering of cold neutrons from VH_x, NbH_x, and PdH_x systems was measured at low hydrogen concentrations. The difference between the normalized intensity of the "hydrogen system" and that of the pure host lattice reveals the neutron scattering distribution of the "hydrogen probe" in the host lattice. These intensity distributions show the expected high energy "local" modes of the hydrogen impurity well above the maximum frequency of the host lattice. For VH_x and NbH_x in the α phase, a low energy neutron distribution of a few meV is also observed, close to the energy of the impinging neutrons. Apart from a certain distortion near the maximum host lattice frequency, in addition, the host lattice frequency distribution can be "seen" through the hydrogen "band" modes. For Nb, two pronounced peaks are found at energy transfers of 25.9 and 18.3 meV. They agree reasonably well with recent calculations of the frequency distribution of Nb. Author

N67-28057# Michigan Univ., Ann Arbor. Dept. of Nuclear Engineering.
NEUTRON SCATTERING IN STRETCH ORIENTED POLYETHYLENE
W. Myers, G. C. Summerfield, and J. S. King *In* Brookhaven Natl. Lab. Symp. on Inelastic Scattering of Neutrons by Condensed Systems Mar. 1966 p 126–130 refs (See N67-28041 15-24)

Measurements on stretch-oriented polyethylene held at 100°K have been undertaken in an attempt to identify clearly the frequency limit of the calculated stretch-band acoustic mode. A simplified "constant-Q" scattering technique was used in order to isolate the longitudinal C–C–C motion. A frequency limit was observed at 525±15 cm^{-1}. The persistence of the torsional mode response in the longitudinal experiment is unexpectedly large. Author

N67-28058# General Dynamics Corp., San Diego, Calif.
EXPERIMENTAL DETERMINATION OF NEUTRON INELASTIC SCATTERING IN POLYETHYLENE
W. L. Whittemore *In* Brookhaven Natl. Lab. Symp. on Inelastic Scattering of Neutrons by Condensed Systems Mar. 1966 p 131–137 refs (See N67-28041 15-24)
(Contract AT(04-3)-167)

High density, crystalline polyethylene is an example of a one-dimensional crystal. Several theoretical treatments have been aimed at generating neutron scattering cross sections: Parks uses a realistic frequency distribution; Goldman, and Koppel and Young use a series of isolated frequencies to approximate the frequency distribution. McMurry has calculated the cross section for n-butane, a significant component of which is the CH_2 radical. The theoretical results have been compared with results obtained by using the General Atomic neutron scattering apparatus and the electron linear accelerator. Monoenergetic neutrons with incident energies of 0.167, 0.233, 0.408, and 0.499 eV were scattered by a "thin" specimen (0.013 inch) of polyethylene at angles of 30°, 60°, 90°, and 150°. Detailed comparisons between experiment and theory reveal that the theories need further adjustment to maximize the fit. In general, the treatment using a distributed frequency distribution gives the better fit to experimental data. All treatments tend to overestimate the strength of the energy levels in the range up to 0.175 eV and to underestimate the strength of the levels around 0.35 eV because of the H—C motion. Author

N67-28059# Reactor Instituut, Delft (Netherlands).
INELASTIC NEUTRON SCATTERING BY SOLID AND LIQUID CYCLOHEXANE
L. A. De Graaf *In* Brookhaven Natl. Lab. Symp. on Inelastic Scattering of Neutrons by Condensed Systems Mar. 1966 p 138–141 refs (See N67-28041 15-24)

The diffusive motions in liquid and solid cyclohexane were investigated by using the rotating-crystal spectrometer at the Delft reactor. Scattering spectra of the solid at 165°K and of the liquid at 295°K and 330°K were measured at 6 different scattering angles between 18° and 80°. The experimental results are compared with other diffusion models. Above the phase transition point (186°K) the measured self-diffusion coefficients do not vary appreciably from the value $D=5.5\times10^{-5}$ cm^2/sec determined at 295°K. This indicates that the motion of the protons within a molecule is more important than the motion of the molecule as a whole. Author

N67-28060# Michigan Univ., Ann Arbor. Dept. of Nuclear Engineering.
INELASTIC SCATTERING OF THERMAL NEUTRONS FROM PRESSURIZED ETHANE
E. A. Straker, J. S. King, J. M. Carpenter, and D. H. Vincent *In* Brookhaven Natl. Lab. Symp. on Inelastic Scattering of Neutrons by Condensed Systems Mar. 1966 p 142–148 refs (See N67-28041 15-24)

Inelastic neutron scattering techniques were used to investigate molecular motions of ethane at room temperature. Both liquid and gaseous ethane were studied by means of pressure variation. Data at scattering angles of 90° and 22° were obtained for neutron energies in the range from 0.046 to 0.020 eV on the four-rotor mechanical monochromator. Triple-axis crystal spectrometer measurements for neutron energies of 0.035 and 0.064 eV were also made. These data indicate that there is no significant difference in the scattering properties of ethane in the gas and liquid state. Effects of the torsional motion of the methyl groups about the carbon–carbon bond are evident in the low angle, low energy data but are obscured at the large scattering angle. Comparison of experiment with theory indicates that a Krieger–Nelkin model which includes a harmonic oscillator representation of the torsional

motion and the effects of zero-point vibrations predicts the observed data approximately. The influence of multiple scattering on the final energy distribution for both small and large scattering angles has been observed and is discussed. Author

N67-28061# Phillips Petroleum Co., Idaho Falls, Idaho. Atomic Energy Div.

APPLICATION OF THE LANGEVIN EQUATION TO THE SCATTERING OF NEUTRONS FROM LIQUID METHANE

George W. Griffing *In* Brookhaven Natl. Lab. Symp. on Inelastic Scattering of Neutrons by Condensed Systems Mar. 1966 p 149–154 refs (See N67-28041 15-24)

The Langevin equation of Brownian motion is used to analyze the scattering of neutrons by liquid methane. The scattering of a neutron by a molecule in the liquid is formulated similarly to the scattering by a molecule in a gas except that the positional coordinate of the center of mass of the molecule is assumed to obey the Langevin equation. To obtain agreement with the experimental data it is necessary for the viscous damping coefficient η appearing in the Langevin equation to be treated as an adjustable parameter. The minimum momentum transfer in the experiments is 0.8Å^{-1}, and the maximum momentum transfer for which the scattering can be distinguished from that expected for a gas is 2.2Å^{-1}. Plotting the value of η needed to fit the quasi-elastic peak against the above range of momentum transfers on a semilogarithmic graph resulted in a straight line of negative slope. An extrapolation of this straight line to zero momentum transfer gave a value of $1.7\times10^{13}\text{sec}^{-1}$ for η, in agreement with the macroscopic experimental value. It is pointed out that the analysis is, at least qualitatively, in accord with the scattering of neutrons by other liquids. There is evidence, although not conclusive, that the rotational motion is partially hindered. Author

N67-28062# Battelle-Northwest, Richland, Wash.

A MODIFIED KINETIC MODEL FOR THE CALCULATION OF $G_s(r,t)$ IN DENSE FLUIDS

Alan G. Gibbs *In* Brookhaven Natl. Lab. Symp. on Inelastic Scattering of Neutrons by Condensed Systems Mar. 1966 p 155–158 refs (See N67-28041 15-24)

(Grant NSF GP-1552)

A model is proposed for the calculation of Van Hove's $G_s(r,t)$ in a classical liquid. The motion of a typical atom is analyzed in terms of the dynamics of an "oscillation," a quasi-particle consisting of the atom plus a surrounding spherical shell representing the collective effect of the instantaneous near neighbors. This shell is assumed to create a harmonic potential well in which the atom oscillates, subject to stochastic forces, while the center of mass moves according to a recently proposed model in which oscillatory motion is neglected. Thus the previous work is generalized to include oscillatory effects, which are found to contribute significantly to $S_s(k,w)$, the Fourier transform of $G_s(r,t)$, for intermediate values of k. Comparison with Rahman's calculations for liquid argon shows good agreement for both $\langle r^2(t)\rangle$ and the non-Gaussian effects. Author

N67-28063# Atomic Energy Commission Research Establishment, Riso (Denmark).

INELASTIC SCATTERING OF NEUTRONS BY SPIN WAVES IN TERBIUM

J. C. Gylden Houmann (Tech. Univ., Copenhagen), A. Kowalska (Copenhagen Univ.), H. Bjerrum Moller, and P. A. Mogensen *In* Brookhaven Natl. Lab. Symp. on Inelastic Scattering of Neutrons by Condensed Systems Mar. 1966 p 159–162 refs (See N67-28041 15-24)

The spin wave spectrum of terbium was studied by the inelastic scattering of neutrons. A triple-axis spectrometer situated at the DR3 reactor was used for these experiments, and the spin wave dispersion curves were studied in symmetry directions in the hexagonal plane, using the "constant-Q" method with fixed energy of the scattered neutrons. The specimen was a single crystal of pure terbium metal in the approximate form of a cylinder 5 cm long and 6 mm in diameter. It was placed in a cryostat at liquid nitrogen temperature. Well-defined neutron groups were observed for all the Q-values studied. Their amplitude was generally comparable with the background counting rate. From the observed dispersion curves in the [1, $\bar{1}$,0,0] direction, preliminary values of exchange parameters are estimated. Author

N67-28065# India. Dept. of Atomic Energy, Bombay. Nuclear Physics Div.

EFFECT OF NUCLEAR SPIN CORRECTION ON THE SCATTERING OF NEUTRONS BY MOLECULES

S. K. Sinha and G. Venkataraman *In* Brookhaven Natl. Lab. Symp. on Inelastic Scattering of Neutrons by Condensed Systems Mar. 1966 p 169–172 refs (See N67-28041 15-24)

The scattering of slow neutrons by molecules is usually discussed without considering the restrictions imposed on the molecular wave functions by the presence of identical nuclei in the molecule. The theory is presented of neutron scattering taking into account such effects, with special reference to the spherical top molecule. Matrix elements for the scattering between different symmetrized states are evaluated by group theoretical methods. It is shown that coherent scattering can cause only those transitions which leave the symmetry of the total molecular wave function unchanged, while incoherent scattering can cause transitions between states of different symmetry. The formulas derived for the cross section are different from those obtained in a recent treatment of the same problem. Calculations for methane have been made and are compared with the case in which the effects of nuclear spin correlation are ignored. Author

N67-28067# Wien Univ. (Austria). Inst. for Theoretical Physics.

DENSITY EXPANSION OF THE SELF-CORRELATION FUNCTION FOR THERMAL NEUTRON SCATTERING IN DILUTE SYSTEMS

D. J. Sigmar *In* Brookhaven Natl. Lab. Symp. on Inelastic Scattering of Neutrons by Condensed Systems Mar. 1966 p 175–178 refs (See N67-28041 15-24)

In inelastic scattering one wants to know the correlation functions $\gamma_s(k,t)=\langle\exp[-ik\cdot r(0)]\exp[ik\cdot r(t)]\rangle$; $\langle v(0)\cdot v(t)\rangle$. The short-time expansions of these quantities are calculated for Lennard–Jones interaction of the atoms in powers of the density of the system. How the long-time values of these functions can be derived is also discussed. Author

N67-28068# India. Dept. of Atomic Energy, Bombay.

TROMBAY MULTIARM SPECTROMETER

P. K. Iyengar *In* Brookhaven Natl. Lab. Symp. on Inelastic Scattering of Neutrons by Condensed Systems Mar. 1966 p 179–182 refs (See N67-28041 15-24)

The construction, operation and structural design of the Trombay multiarm spectrometer are briefly reported. It has a monochromator providing neutrons of readily variable energy, and up to five analyzing spectrometers looking at the sample distributed in the range of scattering angles $+120°$ to $-90°$. The spectrometer follows the normal design of a triple-axis spectrometer. The motion of different arms and the incident energy are all controlled by electromechanical automation. This instrument is used for studying phonon energies in crystal lattices simultaneously at different points in reciprocal space. It is noted that in order to keep the important advantage of the triple-axis spectrometer method, it is necessary to be able to work all the arms of a multiarm in the constant-Q mode. R.U.

N67-28069# International Business Machines Corp., New York. Watson Lab.

A STATISTICAL EVALUATION OF ELASTIC SCATTERING DATA WITH APPLICATION TO THERMAL NEUTRON SCATTERING IN LIQUID ARGON

Werner A. Schlup *In* Brookhaven Natl. Lab. Symp. on Inelastic Scattering of Neutrons by Condensed Systems Mar. 1966 p 183–190 refs (See N67-28041 15-24)

The influence of the counting errors in neutron diffraction experiments on the pair-correlation and the potential following from the Percus–Yevick and the hyper-netted chain equations is discussed for the Henshaw data for liquid argon at 84°K. The results are shown to be very sensitive to the small-angle scattering and the choice of the coherent scattering ratio. The uncertainty in the derived pair potentials is of the order of the potential depth. Author

N67-28201# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etude Nucleaires.

CURVES GIVING THE STOPPING POWER OF A NaI(Tl) CRYSTAL FOR γ PHOTONS IN THE ENERGY RANGE 0.01 TO 10 MeV [COURBES DONNANT LE POURVOIR D'ARRET D'UN CRISTAL NaI(Tl) POUR DES ENERGIES DE PHOTONS γ COMPRISES ENTRE 0.01 MeV ET 10 MeV]

E. Pla Jun. 1965 15 p ref In FRENCH
(NP-16500; MNMR-2)

The formulas for the stopping power of a NaI(Tl) crystal for γ photons at energies between 0.01 and 10 Mev were derived. The formulas were evaluated and numerical results were tabulated and graphed. NSA

N67-28204# Connecticut Univ., Storrs. Dept. of Physics.

THEORETICAL INVESTIGATIONS OF RADIATION EFFECTS IN IONIC CRYSTALS Progress Report, 1 Feb. 1966–31 Jan. 1967

Ralph H. Bartram 2 Feb. 1967 23 p refs
(Contract AT(30-1)-3682)
(NYO-3682-2) CFSTI: HC $3.00/MF $0.65

Theoretical investigations of radiation effects in ionic crystals were conducted to account quantitatively for the optical and ESR absorption spectra of radioinduced defects, and to understand other effects of radiation. The theory of positive g-shifts for F-centers in divalent compounds was developed further and a manuscript prepared for publication. A molecular-orbital calculation of a radioinduced molecule ion, $(AlO)^{3-}$ in Al_2O_3, verified the triplet ground state and yielded a reasonable optical absorption. A Heitler–London calculation was required to obtain the observed zero-field splitting. Further progress was made in calculating the band structure of Al_2O_3. Symmetry-adapted Bloch functions and an analytic potential were constructed, and computer programs written for evaluation of matrix elements. An investigation of the anisotropic luminescence of scintillation counters was initiated. The effect is explained in terms of saturation of luminous efficiency and channeling. A preliminary calculation was based on the equipartition theorem, and a more refined stopping-power formula for channeled particles was obtained. A crystal-field calculation for trapped nitrogen atoms in KN_3 was initiated in an effort to determine the correct defect site. A crystal potential calculation was completed, and matrix elements of Russell–Saunders, crystal potential, spin–orbit and spin–spin interactions were obtained within the ground configuration. Author (NSA)

N67-28207# Iowa State Univ. of Science and Technology, Ames.

IMPROVED TECHNIQUE FOR TRACK PROFILE MEASUREMENT IN NUCLEAR EMULSIONS

J. E. Hall and D. J. Zafforano 1 Nov. 1966 7 p Presented at the 6th Intern. Symp. on Corpuscular Photography, Florence, Italy
(Contract W-7405-ENG-82)
(IS-1465; CONF-660713-2) CFSTI: HC $3.00/MF $0.65

A method is described to permit photoelectric determination of mean track width of particles in nuclear emulsions, which involves slowly sweeping the image of a track across a narrow slit in front of a photomultiplier tube. The method consists of using a signal averaging digital computer to average and store the output signal from the photomultiplier tube. NSA

N67-28280# Wisconsin Univ., Madison. Mathematics Research Center.

COMPLEMENTARY VARIATIONAL PRINCIPLES IN NEUTRON DIFFUSION THEORY

A. M. Arthurs Nov. 1966 14 p refs
(Contract DA-31-124-ARO(D)-462)
(MRC-TSR-711; AD-649079) CFSTI: HC $3.00/MF $0.65

Complementary variational principles associated with neutron diffusion in solids are presented. The resulting formulae are used to derive new expressions which provide upper and lower bounds for the absorption probability. Author (TAB)

N67-28302# Grenoble Univ. (France). Faculte des Sciences

LOW ENERGY TRANSITIONS IN SEVERAL ISOTOPES OF LUTETIUM AND YTTERBIUM [ETUDE DE TRANSITIONS DE BASSE ENERGIE DANS QUELQUES ISOTOPES DE LUTECIUM ET D'YTTERBIUM]

Daniel Barneoud (Ph.D. Thesis) [1965] 68 p refs In FRENCH
(NP-16484)

Some low-energy transitions of ^{175}Hf, ^{169}Gd, ^{171}Hf, ^{171}Lu, and ^{170}Lu were studied. A level with spin 1/2 was found in ^{171}Lu as the ground state of the rotation band of the [541] state in the Nilsson $[Nn_z\Lambda]$ configuration. On the contrary it was not possible to show that this configuration exists in ^{175}Lu. The multipolarity of some transitions accompanying the decay of the isotopes ^{175}Hf, ^{171}Hf, and ^{170}Lu were determined or made more precise. It was shown that a semi-empirical correction of the M conversion coefficients makes it possible, beginning with the values tabulated by Rose, to obtain correct values of the conversion coefficients. NSA

N67-28304# Lyon Univ. (France). Institut de Physique Nucleaire.

STUDIES OF CERTAIN TYPES OF (n,α) REACTIONS BY WAVE DISTORTION METHOD [ETUDE DE CERTAINS TYPES DE REACTIONS (n,α) PAR LA METHODE DES ONDES DISTORDUES]

Claude Fayard (Ph.D. Thesis) May 1966 116 p refs In FRENCH
(LYCEN-6638)

Neutron reactions (n,α) were studied within the framework of the distorted-wave Born approximation in which the incident and emergent plane waves of the Butler–Born approximation are replaced by distorted waves drawn from the term analysis of the optical model of elastic scattering at energies corresponding to those put in play during the reaction. An attempt was made to consider only one type of substructure in the target nucleus by supposing that this nucleus was formed of a C core to which an α particle was bound. The results obtained were applied to the study of the $^{16}O(n,\alpha)^{13}C$ reaction. The examination of the angular distribution curves of the (n,α) reaction lead to the conclusion of a direct interaction process. NSA

N67-28305# Groningen Rijksuniversiteit (Netherlands).
STUDIES OF SLOWING DOWN NEUTRONS IN SUBSTANCES [ETUDE DU RALENTISSEMENT DES NEUTRONS DANS LA MATIERE]
Hans Gerard Kaper (Ph.D. Thesis) 1965 110 p refs In FRENCH
(NP-16445)

The general equation of slowing down is given, and some methods proposed for its solution are reviewed. In the A^{-N} approximation the Fourier transformation of the total density of collisions obeys an ordinary differential equation of N order. The solution for the total collision density is then possible, at least in principle. It is shown that by making A approach infinity the differential equation is reduced to an algebraic equation whose solution leads to an expression for the collision density which is known from group theory. The solution of the slowing-down equation in the A^{-1} approximation is given. Numerical results are reported. For a medium with constant cross sections, the shape of the expression of the collision density was determined by the A^{-1} approximation when the mass number is large. The behavior of the collision density at large distances from the source was studied with respect to the total mean free path. A formal series development representing this asymptotic behavior was deduced.
NSA

N67-28318# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
STUDY OF SOME CONTINUOUS SPECTRA PRODUCED BY NUCLEAR REACTIONS WITH LIGHT NUCLEI [ETUDE DE QUELQUES SPECTRES CONTINUS PRODUITS PAR REACTIONS NUCLEAIRES AVEC DES NOYAUX LEGERS]
Luis Marques (Ph.D. Thesis—Paris Univ.) 1966 66 p refs In FRENCH
(CEA-R-3009)

The continuous spectra coming from several nuclear reactions with light nuclei were measured. The spectra can be explained by a two-step reaction mechanism; however, the reactions produced by ^{6}Li are different. A mechanism was proposed to explain their spectra based on the following assumptions: ^{6}Li makes a nuclear molecule with the target which subsequently breaks up in such a way that an α particule comes out with the kinetic energy that it has in the molecule. The calculated spectra and those measured are in good agreement. Author (NSA)

N67-28319# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
CONTRIBUTION TO THE STUDY OF PROTON ELASTIC AND INELASTIC SCATTERING ON C-12 [CONTRIBUTION A L'ETUDE DES DIFFUSIONS ELASTIQUE ET INELASTIQUES DES PROTONS SUR LE CARBONE 12]
Ali Sadeghi (Ph.D. Thesis—Paris Univ., Orsay, France) 1966 72 p refs In FRENCH
(CEA-R-3006)

The results of absolute measurements of cross sections for the scattering of protons by ^{12}C to the two first excited levels are given. The measurements were made from 4.6 to 11.4 MeV at 17 angles for (p,p) and at 15 angles for (p,p) (1st excited level) as well as 8 angles for (p,p') (2nd excited level). A gaseous target with differential pumping was used. The elastic scattering was analyzed using the R-matrix theory with the optical model. Then a new analysis of both (p,p) and (p,p') was achieved using the coupled-wave formalism. The information on the levels of the compound nucleus was completed and was confirmed.
Author (NSA)

N67-28320# Brookhaven National Lab., Upton, N. Y.
ON THE CONSTRUCTION OF NUCLEAR LEVEL SCHEMES USING PRECISE RELATIVE (n, γ)-ENERGIES
O. W. B. Schult 1966 7 p refs Presented at the Slow-Neutron Capture Gamma-Ray Conf., Argonne, Ill.
(Contract AT(30-2)-GEN-16)
(BNL-10996; CONF-661113-5) CFSTI: HC $3.00/MF $0.65

The application of the Ritz energy combination principle in order to find nuclear levels yields reliable combinations even in cases where the number of (n,γ) transitions is very large, if a subset of intense γ-lines is used. An example is considered and it is shown that the chances to find levels by accident are in this case between 28% and 8×10^{-7}%. The possibility of finding a level by accident is considerable if many levels are present to which transitions may lead. An improvement in relative energy accuracy strongly reduces the chance to obtain by accident a state which is deexcited through many transitions. The knowledge of multipolarities can further aid to reduce the chance for accidental combinations. Author (NSA)

N67-28347# Gosudarstvennyi Komitet po Ispolzuvaniyu Atomnoi Energii, Moscow (USSR). Inst. Teoreticheskoi i Eksperimental'noi Fiziki.
REPRESENTATION OF THE FINITE ROTATION MATRIX AS A SUM OVER GLEBSCH–GORDAN COEFFICIENTS
M. S. Marinov 1966 8 p
(NP-16587)

The finite rotation matrix for angular momentum j is decomposed over Clebsch–Gordan matrices representing a complete orthonormalized set of $(2j + 1) \times (2j + 1)$ matrices. The coefficients are found to be proportional to $Y^{(k)}(n)(i \sin 1/2\ \phi)^{k}\ C^{(j+1)}_{2j-k}$ (cos $1/2\ \phi$)(k = 0, ..., 2j), where ϕ and n are the rotation angle and axis and C $_{2j}$s the Gegenbauer polynomial. Author (NSA)

N67-28349# Oak Ridge National Lab., Tenn.
FIRST-ORDER PERTURBATION THEORY AS USED IN THE MULTIGROUP DIFFUSION CODE EXTERMINATOR-2
Melvin Tobias, T. B. Fowler, and D. R. Vondy 10 Jan. 1967 13 p
(Contract W-7405-ENG-26)
(ORNL-TM-1741) CFSTI: HC $3.00/MF $0.65

The application of first-order perturbation theory in the Exterminator-2 code is discussed. The program can be used to calculate the fractional change in multiplication constant per unit change in a macroscopic material constant or per unit change in a specified nuclide density. The equations used are briefly described. The results of test calculations are presented which compare the predictions of perturbation theory with computed Δk values produced by various input parameter changes. Author (NSA)

N67-28350# Rice Univ., Houston, Tex.
NUCLEON-NUCLEON BREMSSTRAHLUNG
William S. Pearce, William A. Gale, and Ian M. Duck 7 Feb. 1967 20 p refs
(Contract AT(40-1)-1316)
(ORO-1316-28; CONF-670302-1) CFSTI: HC $3.00/MF $0.65

Cross sections for bremsstrahlung production in N–N interactions were calculated using the Tabakin separable potentials. The results were compared with experimental observations. NSA

N67-28351# Georgia Inst. of Tech., Atlanta. School of Physics.
LISTING OF AVAILABLE EXPERIMENTAL DATA ON THE FORMATION AND DESTRUCTION OF EXCITED STATES BY COLLISIONS BETWEEN ATOMIC SYSTEMS
E. W. Thomas 30 Oct. 1966 43 p
(Contract AT(40-1)-2591)
(ORO-2591-22; TR-1) CFSTI: HC $3.00/MF $0.65

A listing has been made of the sources of experimental data concerning the formation and destruction of excited states by atom–atom and ion–atom collisions. All processes occurring at

impact energies less than 10 eV have been excluded. The listing is in five sections, each of which includes tabulations of reactants, range of impact energy, assessment of data accuracy and references. The five separate sections are as follows: (1) The formation of excited states by the collision of two ground state atomic structures under single collision conditions. Such data will in general be expressed in the form of cross sections either on an absolute or relative basis. (2) Differential inelastic scattering with the formation of an excited state, by the collision of two atomic structures under single collision conditions. Such data will in general be expressed in the form of a cross section. (3) Collisional quenching of excited states under single collisibn conditions. Such data will in general be expressed in the form of cross sections, either on an absolute or relative basis. (4) The formation of excited states in beams of particles passing through a gas or plasma, under multiple collision conditions. Such data can only be expressed in the form of the relative population of various states in the emergent beam. (5) The formation of excited states in beams of particles passing through a solid target, under multiple collision conditions. Such data can only be expressed in the form of the relative population of various states in the emergent beam. NSA

N67-28352# Georgia Inst. of Tech., Atlanta. School of Physics.
EMISSION AND EXCITATION CROSS SECTIONS Progress Report No. 2, 1 Dec. 1965–30 Nov. 1966
E. W. Thomas, G. D. Bent, and J. L. Edwards 1 Dec. 1966 76 p
(Contract AT(40-1)-2591)
(ORO-2591-23) CFSTI: HC $3.00/MF $0.65

The equipment for investigating the formation of excited states in a gaseous target is briefly described. Excitation cross sections were measured for proton impact on a helium target for each of the ^1S, ^1P, and ^1D levels. Measurements were also made on a single line emitted from the helium ion. Cross sections for excitation of the He target by H^+, H^+, and H^+ ions are also described. Proton excitation cross section measurements were also made for nitrogen, oxygen, and argon. Proton energies ranged from 0.15 to 1 MeV. NSA

N67-28354# Sandia Corp., Albuquerque, N. Mex.
ELECTRON EMISSION FROM TUNGSTEN UNDER PROTON BOMBARDMENT EFFECT OF NITROGEN ADSORPTION
Ronald I. Ewing Jan. 1967 12 p
(Contract AT(29-1)-789)
(SC-R-67-1038; CONF-758-64) CFSTI: HC $3.00/MF $0.65

The yield of electrons emitted from polycrystalline tungsten under bombardment by 100-keV protons is found to depend upon the coverage of the surface by adsorbed nitrogen gas. The tungsten surface was cleaned by the flash-filament method and the yield measured as nitrogen gas adsorbed on the surface to a coverage of about 1.1 layers. The monolayer coverage time was varied from 9.0 minutes to 1.3 minutes by controlling the pressure of the nitrogen gas in the system. The yield increased with increasing surface coverage to about one monolayer, at which the increase over the value for a clean surface was 3.5%. Further adsorption of nitrogen caused the yield to decrease even below the clean surface value. Author (NSA)

N67-28357# California Univ., Livermore. Lawrence Radiation Lab.
AVAILABLE DISINTEGRATION ENERGY OF ALL RADIONUCLIDES (FOR USE IN DOSIMETRY PROBLEMS). I. HALF-LIVES 12 HOURS OR GREATER
Ann C. Burton and Joan H. Maxwell 15 Dec. 1966 34 p
(Contract W-7405-ENG-48)
(UCRL-50164) CFSTI: HC $3.00/MF $0.65

The ERPD computer program calculates the maximum available energy per disintegration for all radionuclides. The input and the results are given for nuclides with half lives greater than 12 hours. Author (NSA)

N67-28382# Instituto de Investigacion Aeronautica y Espacial, Buenos Aires (Argentina).
PHENOMENOLOGICAL ANALYSIS OF ROTATIONAL STATES IN DEFORMED EVEN–EVEN NUCLEI Interim Report, Mar.–Dec. 1966
S. M. Abecasis (DINFIA, Buenos Aires), H. E. Bosch, and C. A. Heras (Oriente Univ.) Dec. 1966 11 p refs
(Grant DA-ARO-49-092-66-6121)
(LR-14; AD-649007) CFSTI: HC $3.00/MF $0.65

A comparison of the rotation-vibration and asymmetric rotor (with beta vibrations) models with recent experimental data on some rare earth nuclei is made. For the three lowest rotational bands good agreement with experiment is obtained. The approximate equivalence between the two models is corroborated. The consistency with calculations based on microscopic theories is also achieved. Author (TAB)

N67-28397# Naval Radiological Defense Lab., San Francisco, Calif.
A MOMENTS METHOD COMPUTER CODE FOR RECONSTRUCTING SCATTERED GAMMA RAY DISTRIBUTIONS
Charles V. Smith 24 Mar. 1967 80 p refs
(USNRDL-TR-67-9; AD-649289) CFSTI: HC $3.00/MF $0.65

Two computer programs are presented which together are used to reconstruct scattered angular-energy distributions of monoenergetic photons from their moments. The source configuration for the reconstruction is plane monodirectional. The first program, called MOMGEN, calculates first and second order scattering moments, adds them together and subtracts their sum from a set of total scattering moments. The results are moments for third and higher scattering. The second program, called MOMDIS, constructs third and higher order scattering distributions with the moments calculated in MOMGEN. Distributions for first and second order scattering, which do not require moments for their formation, are analytically calculated in MOMDIS. The three distributions are added together to give the distribution for total scattering. These programs are written in FORTRAN II for an IBM 704 computer with a 32 K memory. Author (TAB)

N67-28401# California Univ., Berkeley. Lawrence Radiation Lab.
PART I: INTENSITY CORRELATIONS IN INELASTIC SCATTERING EXPERIMENTS. PART II: THEORY OF QUANTUM BEAT AND LEVEL CROSSING EXPERIMENTS UTILIZING ELECTRONIC EXCITATION
Robert L. Kelly (Ph.D. Thesis) 10 Nov. 1966 81 p refs
(Contract W-7405-ENG-48)
(UCRL-17286) CFSTI: HC $3.00/MF $0.65

Part I. Measurements of space–time correlations in the intensity of a beam of scattered particles yield information about the scatterer. Goldberger and Watson have developed a theory of such measurements appropriate to the case of nearly elastic scattering; here their theory is extended to the case of inelastic scattering. The main result is that under certain experimental conditions the correlated counting rate in an inelastic scattering experiment is of a form equivalent to the correlated counting rate for an incoherent beam of particles emitted by a source. This result applies, in particular, to Raman or Brillouin scattering of light by phonons in an extended target. However, estimates of the signal-to-noise ratio for this case indicate that it may not be possible to observe intensity correlations in Raman or Brillouin lines using presently available light sources. Part II. The coherent excitation of several atomic states by inelastic electron scattering and their subsequent radiative decay is considered. General expressions for the photon counting rate in a quantum beat experiment, and the total number of photons counted in a level-crossing experiment are derived. The general results are used to calculate the phase of the oscillatory part of the photon counting rate in the Hadeishi–Nierenberg quantum beat experiment. Author (NSA)

N67-28415# Deutsche Akademie der Wissenschaften zu Rossendorf (East Germany). Zentralinstitut fuer Kernforschung.
INVESTIGATION OF THE CHARACTERISTICS OF DEFORMED NUCLEI WITH UNEVEN NUCLEON NUMBERS IN THE MASS REGION 150 < A < 190 [DIE UNTERSUCHUNG DER EIGENSCHAFTEN DEFORMIERTER KERNE MIT UNGERADER NUKLEONENZAHL IM MASSENBEREICH 150 < A < 190]
Lothar Funke, Heinz Graber, Karl-Heinz Kaun, and Horst Sodan Sep. 1966 253 p refs In GERMAN; ENGLISH summary
(ZFK-PHA-23)

Experimental results are presented which were obtained during the study of the decay of deformed nuclei in the mass region 150 < A < 190. In order to discuss these results in connection with modern nuclear models, the important aspects of the unified model as well as the features of the microscopic description of nuclear states are reviewed. The experiments performed are described. Details are given for the preparation of the radioactive sources and for the multiparameter method used in the coincidence measurements. The work includes the investigation of the following nuclear decays: $^{151}Pm(\beta^-)^{151}Sm$, $^{153}Sm(\beta^-)^{153}Eu$, $^{155}Sm(\beta^-)^{155}Eu$, $^{155}Eu(\beta^-)^{155}Gd$, $^{157}Eu(\beta^-)^{157}Gd$, $^{157}Dy(EC)^{157}Tb$, $^{159}Gd(\beta^-)^{159}Tb$, $^{161}Gd(\beta^-)^{161}Tb$, $^{161}Tb(\beta^-)^{161}Dy$, $^{163}Tb(\beta^-)^{163}Dy$, $^{163}Er(EC)^{163}Ho$, $^{169}Ho(\beta^-)^{169}Er$, $^{175}Hf(EC)^{175}Lu$, $^{181}Hf(\beta^-)^{181}Ta$, $^{187}W(\beta^-)^{187}Re$, $^{162}Tb(\beta^-)$ ^{162}Dy, $^{174}Lu(EC)^{174}Yb$. On the basis of these measurements the level schemes of the daughter nuclei were established or improved. A systematic summary is given of the properties of deformed odd-mass nuclei in the region 150 < A < 190. This summary contains the experimental results of this work as well as the experimental results of other authors published up to May 1966. This includes energies of one-quasiparticle states and β-vibrational states, moments of inertia, decoupling parameters, γ branching ratios of E1-transitions, and β transition probabilities.
Author (NSA)

N67-28416# Brookhaven National Lab., Upton, N. Y.
GAMMA-RAY SPECTROSCOPY IN VAN DE GRAAFF RESEARCH
David E. Alburger [1966] 43 p refs Presented at the Intern. Conf. on Low Energy Nucl. Phys., Dacca, East Pakistan, 16–27 Jan. 1967
(Contract AT(30-2)-GEN-16)
(BNL-10863; CONF-670103-1) CFSTI: HC $3.00/MF $0.65

A review is presented of the techniques used by the Brookhaven Van de Graaff group in the study of gamma rays from the excited states of light nuclei. The topics include the determination of multipolarities with a magnetic pair spectrometer, studies of gamma rays from short-lived activities, gamma-ray angular distributions and correlations, and various methods using lithium-drifted germanium detectors. The operating characteristics of the Brookhaven Van de Graaff accelerator are also described briefly.
Author (NSA)

N67-28420# Deutsche Akademie der Wissenschaften zu Rossendorf (East Germany). Zentralinstitut fuer Kernforschung.
SOME LIFETIME MEASUREMENTS IN THE NANOSECOND REGION [EINIGE LEBENSDAUERMESSUNGEN IM NANOSEKUNDENGEBIET]
Wolfgang Meiling and Franz Stary Feb. 1967 48 p refs In GERMAN; ENGLISH summary
(ZFK-PHA-20)

Measurements of nanosecond lifetimes of excited nuclear states were performed, using delayed coincidences. The investigations were related to levels in the spherical nuclei ^{99}Mo, ^{99}Tc, and ^{141}Pr, the deformed odd-mass nuclei ^{153}Eu, ^{161}Dy, ^{175}Lu, and ^{181}Ta, and the deformed even-mass nuclei ^{158}Gd, ^{160}Dy, ^{170}Yb, and ^{182}W. The results are compared with values taken from the literature.
Author (NSA)

N67-28421# Oak Ridge National Lab., Tenn.
INELASTIC SCATTERING OF 40-MeV POLARIZED PROTONS
Martin P. Fricke (Ph.D. Thesis—Minn. Univ.) Mar. 1967 143 p refs
(Contract W-7405-ENG-26)
(ORNL-TM-1753) CFSTI: HC $3.00/MF $0.65

The left–right asymmetry and differential cross section for the inelastic scattering of 40-MeV polarized protons were measured over a large angular region for each of the following 2^+ excitations: 1.78 MeV in ^{28}Si, 1.41 and 2.97 MeV in ^{54}Fe, 1.45 MeV in ^{58}Ni, and 1.33 MeV in ^{60}Ni. Some asymmetry and cross-section data were also obtained for 3^- states: 6.9 MeV in ^{28}Si, 4.8 and 6.4 MeV in ^{54}Fe, 4.5 MeV in ^{58}Ni, and 4.08 MeV in ^{60}Ni. Elastic polarization and cross section data were obtained for each target. The inelastic scattering was analyzed in the distorted-wave approximation using the collective-model extension of the optical-model potential determined by fitting the elastic scattering. The inelastic asymmetry and cross section data are best reproduced with a collective-model interaction obtained by deforming the complete optical potential, including its imaginary and spin-orbit parts.
Author (NSA)

N67-28424# Brookhaven National Lab., Upton, N. Y.
SINGLE PULSE TRANSVERSE PHASE SPACE BEAM ANALYZER
J. M. Th. Sluyters, R. Damm, and A. Otis 1966 11 p Presented at the Natl. Particle Accelerator Conf., Washington, D. C.
(Contract AT(30-2)-GEN-16)
(BNL-11111; CONF-670307-13)

A device is described with which total and partial horizontal or vertical emittances can be measured in shorter than 40 μs.
Author (NSA)

N67-28427# California Univ., Berkeley. Lawrence Radiation Lab.
COMPARISON OF THE POSITIVE AND NEGATIVE MUON DECAY SPECTRA IN COPPER
Philip Bert Beilin (Ph.D. Thesis) 28 Nov. 1966 114 p refs
(Contract W-7405-ENG-48)
(UCRL-16168) CFSTI: HC $3.00/MF $0.65

Negative muons from the Berkeley 184-in. Synchrocyclotron were stopped in a copper plate target. The momenta of the decay electrons were measured by an Elbek-type wide-gap, broad-range, magnetic spectrometer. Eleven scintillation counters served to define the focal plane for trajectories from the target, through the spectrometer, to the focal plane. For comparison, positive pions were stopped in the copper target giving rise to positive muons upon their decay. The positrons from the subsequent positive muon decay were momentum analyzed under the same experimental conditions as the electrons. The measured positive and negative electron momenta spectra are compared to the theoretical predictions taking into account energy loss straggling and various other experimental resolution effects. Reasonably good agreement was obtained between the positive data and theory. The comparison between the negative decay spectrum and theory seems to be in a less satisfactory state of agreement, the data favoring a faster fall-off with energy at the upper end of the spectrum than theoretically predicted.
Author (NSA)

N67-28429# Stanford Univ., Calif. Linear Accelerator Center.
STREAMER CHAMBER DEVELOPMENTS AT SLAC
A. Odian Oct. 1966 11 p Presented at the Intern. Conf. on Instrumentation for High Energy Phys., Stanford, Calif., 9–10 Sep. 1966
(Contract AT(04-3)-400)
(SLAC-PUB-252; CONF-660918-18) CFSTI: HC $3.00/MF $0.65

The development of several streamer chamber systems at SLAC are discussed. Topics included are ionization measurements,

problems with large streamer chambers, treating large streamer chambers as transmission lines, photography, and high voltage technology. NSA

N67-28434# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics.
MEASUREMENT OF THE REACTION Nd(n,α) ON RESONANCE NEUTRONS
I. Kvitek and Yu. P. Popov 1967 11 p refs In RUSSIAN; ENGLISH summary
(JINR-P3-3104)

The reaction (n,α) was investigated on the natural mixture of the neodymium isotopes at neutron energies up to 400 eV. The occurrence of the reaction (n,α) on the ^{146}Nd isotope is proved by experiment. The values of Γ_α for separate resonances are given. For the ^{143}Nd resonances the values of Γ_α are also obtained and an identification of a number of levels by spins is carried out. The average α-particle widths are compared with the calculations on statistic theory. Author (NSA)

N67-28435# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
INVESTIGATION OF TWO-PARTICLE DISINTEGRATION IN THREE-BODY PROBLEM
B. Akhmadkhadzhaev and V. B. Belyaev 1967 8 p In RUSSIAN; ENGLISH summary
(JINR-P4-3154)

The convergence of two-particle disintegrations is investigated by the example of a precise solution of the three-body problem. Author (NSA)

N67-28436# Illinois Univ., Urbana.
THREE- AND FOUR-BODY STRANGE-PARTICLE FINAL STATES FROM 8 GeV/c p–p INTERACTIONS
M. Firebzugh, G. Ascoli, E. L. Goldwasser, and R. D. Sard 1967 18 p refs
(Contract AT(11-1)-1195)
(COO-119-5-72; CONF-670109-6) CFSTI: HC$3.00/MF$0.65

Results on the $K^+p\Lambda$ and $\pi KN\Lambda$ final states from p+p interactions in a hydrogen bubble chamber using 8 GeV/c protons are discussed. The invariant mass distributions and four-momentum transfer to the outgoing proton are presented. Also the corresponding phase space predictions for the $K^+p\Lambda$ final state events are shown. One meson exchange predictions are examined. It is concluded that the Y_1^* (1385) and N^* (1236) are present to about the same extent in the $\pi KN\Lambda$ final states of GeV/c. In addition it appears that the Y_1^* (1680) production is increasing in this same region. NSA

N67-28439# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Obninsk (USSR).
ON THE POSSIBILITY OF USING A NUCLEAR REACTOR IN COSMIC SPACE FOR MEASURING CROSS SECTIONS OF (n–n) SCATTERING
I. I. Bondarenko, V. P. Kovalev, and V. G. Zolotukhin 1965 8 p refs Transl. into ENGLISH from Yadern. Fiz., v. 2, Nov. 1965 p 839–842
(AEC-TR-6793)

An analysis of an experiment for the direct measurement of the n–n scattering cross section in the singlet state is performed. For the measurement of the cross section, a pulsed nuclear reactor having a negative temperature coefficient and located in cosmic space at an altitude of 400 to 500 km is proposed. It is shown that the scattering length can be determined with an error of ±10%. Author (NSA)

N67-28440# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR). Institut Teoreticheskoi i Eksperimental'noi Fizik.
AT WHAT DISTANCE DO HIGH ENERGY INTERACTIONS OCCUR?
V. N. Gribov 1965 15 p refs Transl. into ENGLISH from Yadern. Fiz., IV. 2, Oct. 1965 p 768–776
(AEC-TR-6800)

It is possible to determine at what distances high energy elastic and inelastic scattering occurs by investigating experimentally the emission of soft photons accompanying the given scattering process. If it proves that the region in which the usual formula for the accompanying radiation can be applied decreases as the energy of the incident particles increases, this will mean that the effective longitudinal distances at which the interaction occurs at high energies increase as the energy increases. Author (NSA)

N67-28450# United Kingdom Atomic Energy Authority, Harwell (England). Atomic Energy Research Establishment.
A METHOD OF STUDYING INELASTIC SCATTERING OF SLOW NEUTRONS BY MULTI-PARTICLE SYSTEMS
W. Glaeser Sep. 1965 45 p refs Transl. into ENGLISH of Kernforschungszentrum Rept. No. KFK-261, Nov. 1964
(NP-TR-1404; KFK-261)

For the production of pulsed monochromatic beams double choppers and rotary crystal spectrometers are used. These two types of monochromators are compared with respect to resolution and intensity. The background problem was discussed. The rotary crystal, time-of-flight spectrometric installation of the DIORIT reactor was described. Simple approximation formulas for primary and secondary energy resolution were derived. The Doppler effect was discussed, and a comparison with the measurement results was carried out. A simple measurement and evaluation method for the determination of two-fold differential scattering cross sections and for the determination of the scattering law was described. NSA

N67-28454# General Electric Co., Schenectady, N. Y. Knolls Atomic Power Lab.
SOME MATHEMATICAL PROPERTIES OF THE MULTICHANNEL VARIATIONAL SYNTHESIS EQUATIONS AND TWO-DIMENSIONAL SYNTHESIS NUMERICAL STUDIES
E. L. Wachspress 12 Dec. 1966 31 p refs
(Contract W-31-109-ENG-52)
(KAPL-M-6588) CFSTI: HC$3.00/MF$0.65

It is proved that the matrix approximating the group diffusion operator $(-\nabla\cdot D\nabla+A)$ in the multichannel variational synthesis mockup is positive definite. Some numerical studies of a highly nonseparable reactor are described. Author (NSA)

N67-28456# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy.
STUDY OF NEUTRAL BOSONS DECAYING INTO π^0 MESONS AND γ QUANTA
Z. S. Strugalski, I. V. Chuvilo, I. A. Ivanovskaja, L. S. Okhrimenko, B. Niczyporuk et al 1967 32 p refs
(JINR-E1-3100)

The production and decays of neutral bosons into π^0 mesons and γ quanta are searched in film obtained in an exposure of a 23-inch xenon bubble chamber. The distribution of the effective masses $m_{\gamma\gamma}$, $m_{\pi^0\pi^0}$, $m_{\pi^0\gamma\gamma}$ of, γγ, $\pi^0\pi^0$, and $\pi^0\gamma\gamma$ are presented and analyzed. Author (NSA)

N67-28458# Illinois Univ., Urbana.
PRODUCTION OF Ω^- HYPERONS IN K^-p INTERACTIONS AT 5.5 BeV/c

P. F. Schultz, G. Ascoli, T. O'Halloran, S. Dagan (Argonne Natl. Lab.), R. Hartung (Wisconsin Univ.) et al [1967] 17 p. Presented at the Ann. Meeting of the Am. Phys. Soc., New York, 30 Jan.–2 Feb. 1967. Prepared jointly with Argonne Natl. Lab., Northwestern Univ., and Wisconsin Univ.
(Contract AT(11-1)-1195)
(COO-1195-79; CONF-670109-5) CFSTI: HC $3.00/MF $0.65

Hyperon (Ω^-) events were found in 400,000 pictures of K^-+p interactions in a hydrogen bubble chamber. The beam momentum was 5.5 GeV/c. The mass, decays, and lifetimes of the hyperon (Ω^-) are studied. NSA

N67-28460# Brookhaven National Lab., Upton, N. Y. Information Div.
PROOF OF SPECIAL RELATIVITY THEORY BY HIGH ENERGY PHYSICS EXPERIMENTS
D. I. Blokhintsev [1966] 35 p refs Transl. into ENGLISH of Joint Inst. for Nucl. Res., Dubna, USSR, Rept. JINR-P-2422
(BNL-TR-70; JINR-P-2422)

An analysis is given of the verification of the basic principles of relativity theory in the domain of high-energy physics. The theoretical bases for the proof of special relativity in the region of high energies and small scales are reviewed, for the case of internal four-dimensional time vector, n, where n is associated with the matter of the interacting elementary particles and the case of external n, where n is associated with the physical vacuum. Consideration is given to the proofs of microcausality, of the asymptotic relations between cross sections, and the homogeneity and isotropy of space–time. NSA

N67-28464# Commissariat a l'Energie Atomique, Cadarache (France).
ESTABLISHMENT OF NEUTRON FLUXES AND DOSES AFTER A CRITICALITY ACCIDENT USING THE MULTISPHERE TECHNIQUE
G. Benezech and H. Zaborowski May 1966 29 p refs In FRENCH
(NP-TR-1406)

The multi-sphere technique can be used to establish neutron fluxes and doses over an energy range between thermal and about 7 MeV. This technique consists of using thermal neutron detectors at the center of polyethylene spheres of various diameters. The responses, for monoenergetic incidental fluxes, are interpolated from experimental data obtained by others with 2-, 2.5-, 10-, and 12-in. spheres. Direct addition of the responses of certain units to neutron fluxes of unknown spectra provides: neutron flux values with an estimated accuracy of ±10%; and kerma and absorbed doses with an estimated accuracy of ±15%. Two detection units were developed. The first is a unit whose thermal neutron detector consists of a 4 mm × 4 mm ^{6}Li crystal, for measuring fluxes of the order of 2 n $cm^{-2}s^{-1}$ and dose rates of 0.5 mrem/h. The second is a unit whose thermal neutron detector consists of a 6 mm × 6 mm gold cylinder, for measuring integrated fluxes of the order of 10^6 n/cm^2 and integrated doses of the order of 0.5 Rem. A spectrometric method applicable to neutrons in the intermediate energy range was devised from the responses with various spheres. Data obtained from trials with these units using an unmoderated fission source are included. Author (NSA)

N67-28465# Oak Ridge National Lab., Tenn.
HIGH FLUX ISOTOPE REACTOR Quarterly Report, Jul.–Sep. 1966
R. V. McCord and B. L. Corbett 17 Jan. 1967 21 p
(Contract W-7405-ENG-26)
(ORNL-TM-1752) CFSTI: HC $3.00/MF $0.65

Following the startup program of operating at progressively higher power, the full reactor design power level of 100 MW was reached on September 9, 1966, at the start of cycle 4. The reactor has been operated with no major problems occurring. The approach of routine operation is indicated by the fact that the reactor operated at power levels of 10 MW or above 84.7% of the time this quarter. Major maintenance jobs this quarter consisted of repairing a leaking primary heat-exchanger tube, reinforcing the foundations of the secondary coolant circulating pumps, and slightly modifying the reactor control system. Author (NSA)

N67-28466# Illinois Univ., Urbana.
$\Sigma^+\pi^-$ AND $\Sigma^+\pi^+\pi^+\pi^-$ FINAL STATES IN K^-p INTERACTIONS AT 4.1 AND 5.5 GeV/c
J. S. Loos, E. L. Goldwasser and U. E. Kruse 6 Feb. 1967 18 p refs Presented at Ann. Meeting of the Am. Phys. Soc., New York, 30 Jan.–2 Feb. 1967
(Contract AT(11-1)-1195)
(COO-1195-80; CONF-670109-4) CFSTI: HC $3.00/MF $0.65

K^-+p exposures at 4.1 and 5.5 GeV/c were taken from which preliminary results on the study of the $\Sigma^+\pi^-$ and $\Sigma^+\pi^+\pi^+\pi^-$ final states produced are reported. The report is based on data from all of the 4.1-GeV/c film and from about 40% of the 5.5 GeV/c film. Highly peripheral production is observed in the process $K^-+p \rightarrow \Sigma^+ + \pi^-$ at both 4.1 and 5.5 GeV/c. It is also observed that the process $K^- + p \rightarrow \Sigma^* + \pi^+ + \pi^+ + \pi^+ + \pi^-$ is dominated by the 3-body final states: $Y^*\pi\pi$ and $\Sigma^+\pi^+$ plus neutral meson. No evidence is found for new Y^* resonance production. NSA

N67-28467# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
TO THE PROBLEM OF NEUTRON ASYMMETRY AT μ-CAPTURE ON NUCLEI [K VOPROSU OB ASIMMETRII NEITRONOV PRI μ-ZAKHVATE NA YADRAKH]
V. B. Belyaev and R. A. Eramzhyan 1967 8 p refs In RUSSIAN
(JINR-P4-3153)

The asymmetry of the neutron emergence from the polarized μ-meson capture is investigated on the basis of the two-particle effective Hamiltonian. The maximum value of the asymmetry (+1) is obtained neglecting the momentum of a recoil nucleus. Author (NSA)

N67-28468# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
ON QUASI-INDEPENDENT QUARK MODEL [O MODELI KVAZINEZAVISIMYKH KVARKOV]
P. N. Bogolyubov 1967 30 p refs In RUSSIAN
(JINR-P2-3115)

A nonrelativistic model of quasi-independent quarks is considered. It is used to obtain the baryon magnetic moments and the relations for axial and vector constants and other parameters which agree well with experiment. Author (NSA)

N67-28470# Ceskoslovenska Akademie Ved, Rez. Ustav Jaderneho Vyzkumu.
INVESTIGATION OF THE GAMMA-RAY SPECTRUM FROM THE RESONANCE NEUTRON CAPTURE IN Cl^{35}.
F. Becvar, J. Honzatko, and Z. Kosina Nov. 1966 10 p refs
(UJV-1705)

Using the fast chopper and the scintillation spectrometer, the spectrum of the gamma rays following the resonance neutron capture at 405 eV in ^{35}Cl was measured. Analysis of the spectrum was performed. The strengths of some primary transitions are given. The resonance state $J^\pi = 0^-$ was excluded. Author (NSA)

N67-28472# California Univ., Berkeley. Lawrence Radiation Lab.
NUCLEAR REACTIONS INDUCED BY HIGH ENERGY PARTICLES
N. A. Perfilov, O. V. Lozhkin, and V. I. Ostrovmov [1967] 453 p refs Transl. into ENGLISH from the book "Yadernye Reaktsii pod Deistviem Chastits Vysokikh Energii" Moscow, Akad. Nauk SSSR
(UCRL-TRANS-949, Rev.) CFSTI: HC $3.00/MF $0.65

A review is given of the process of inelastic interactions of high-energy particles (approximately from 50 MeV, where the Bohr formalism of the compound nucleus stops being valid, up to 10^4 MeV) with nuclei. The fundamental experimental results that were obtained during the study of nuclear reactions, as well as a comprehensive review of the theoretical representations concerning the nuclear interactions, are presented. NSA

N67-28473# California Univ., Berkeley. Lawrence Radiation Lab.
MEASUREMENT OF THE POLARIZATION PARAMETER IN THE ELASTIC SCATTERING OF NEGATIVE PIONS BY PROTONS FROM 600 TO 3300 MeV/c
Michel Hansroul (Ph.D. Thesis) Jan. 1967 71 p refs
(Contract W-7405-ENG-48)
(UCRL-17263) CFSTI: HC $3.00/MF $0.65

The polarization parameter in π^-p elastic scattering was measured at eleven incident-pion momenta ranging from 0.6 to 3.3 GeV/c. The negative pion beam was focused on a polarized proton target and the scattered pion and recoil protons were detected in coincidence by counter hodoscopes. The polarization parameter was obtained from a measurement of the difference in counting rates for the target protons' spins parallel and antiparallel to the normal to the scattering plane. An on-line PDP-5 computer was used in the data encoding and transferred the information onto magnetic tape for later computer analysis. The results serve to fill in some gaps in previous experiments. An attempt to fit the new data and previously available data by means of a phase-shift analysis for energies below 1050 MeV was successful in finding good fits to the data but was unsuccessful in that no unique solution was demonstrated. Author (NSA)

N67-28476# Columbia Univ., Irvington, N. Y. Nevis Labs.
THE NEUTRAL DECAYS OF THE η MESON
Jacob Grunhaus (Ph.D. Thesis) Dec. 1966 112 p refs
(Contract AT(30-1)-1932)
(NEVIS-156; CU-1932-260; R-573) CFSTI: HC $3.00/MF $0.65

The branching ratios of the neutral decays of the η meson was studied experimentally in the reaction $\pi^-p \rightarrow n\eta$ at incident π^- momentum of 780±8 MeV/c. The distribution of the number of gamma rays attributed to the neutral decays of the η meson was χ^2 fitted to the expected distribution, as obtained using the Monte Carlo technique first assuming three neutral modes ($3\pi^0$, $\pi^0\gamma\gamma$, and $\gamma\gamma$) and then assuming only two neutral modes ($3\pi^0$ and $\gamma\gamma$). The data are more consistent with the existence of three modes χ^2=0.8 (a 4° of freedom fit) than with only two modes χ^2 = 17.6 (a 5° of freedom fit). The existence of a substantial rate (comparable to the rates of the other neutral modes) for the decay $\eta \rightarrow \pi^0\pi^0\gamma$ is not consistant with the data. The following results were obtained: $R_1 = [\Gamma(\eta \rightarrow \gamma\gamma)/\Gamma(\eta \rightarrow \text{neutrals})] = 0.44\pm0.07$, $R_2 = [\Gamma(\eta \rightarrow \pi^0\gamma\gamma)/\Gamma(\eta \rightarrow \text{neutrals})] = 0.27\pm0.10$, and $R_3 = [\Gamma(\eta \rightarrow 3\pi^0)/\Gamma(\eta \rightarrow \text{neutrals})] = 0.29\pm0.10$. Author (NSA)

N67-28478# Los Alamos Scientific Lab., N. Mex.
STUDY OF DYNAMICS OF LITHIUM HYDRIDE AND DEUTERIDE BY INELASTIC SCATTERING OF COLD NEUTRONS [ISSLEDOVANIIA DINAMIKI GIDRIDA I DEITERIDA LITLIA PO NEUPRUGOMU RASSEIANIIU KHOLODNYKH NEITRONOV]
M. G. Zemlyanov, E. G. Brovman, N. A. Chernoplekov, and Yu. L. Shitikov 1964 37 p refs Transl. into ENGLISH of Institut Atomnoi Energii Report IAE-756
(LA-TR-65-35; IAE-756)

Experimental investigations are reported on the inelastic scattering of cold neutrons in polycrystalline samples of ^{7}LiH and ^{7}LiD. The measurements are carried out by the time-of-flight method, using a beryllium filter and mechanical chopper. In processing the data, allowance is made for the instrumental resolution and the statistical accuracy of the experimental data. A detailed theory is described for LiH and LiD crystals in models of stable ions. Calculations are made of frequency distribution functions and the energy dependence of the polarization vectors, and the Debye–Waller factor is found. The behavior of the neutron inelastic scattering cross section resulting from the presence of two atoms in the elementary nucleus is discussed. The phonon spectra for lithium hydride and deuteride are established using the values computed from the experimental results. The paper includes a comparison of the experimental and theoretical results. Author (NSA)

N67-28480# California Univ., Berkeley. Lawrence Radiation Lab.
MEASUREMENT OF THE Σ^- POLARIZATION IN THE PROCESS $\pi^-+p \rightarrow \Sigma^-+K^+$
David Michael Weldon (Ph.D. Thesis) Feb. 1967 52 p refs
(Contract W-7405-ENG-48)
(UCRL-17152) CFSTI: HC $3.00/MF $0.65

The average polarization of the Σ^- produced in the reaction $\pi^- + p \rightarrow \Sigma^- + K^+$ was measured between center-of-mass angles 134 and 166° for an incident π^- momentum of 1145 MeV/c. A polarized proton target was used and the Σ^- polarization was found by measuring the difference in the production-rate of K^+ mesons for protons polarized along the production-plane normal and against it. Spark chambers were used to record the π^- and K^+ trajectories, and the π^- momentum was obtained from a magnetic spectrometer while the K^+ momentum was obtained from a range telescope. Each event was kinematically reconstructed in a one constraint fit to help eliminate events produced from protons bound in heavy nulcei of the target. The Σ^- polarization was found to be -0.36 ± 0.46. Author (NSA)

N67-28481# Kernforschungszentrum, Karlsruhe (West Germany). Institut fuer Angewandte Kernphysik.
THE FISSION CROSS-SECTIONS OF SOME PLUTONIUM ISOTOPES IN THE NEUTRON ENERGY RANGE 5 TO 150 KeV
W. B. Gilboy and G. Knoll Oct. 1966 12 p refs Presented at Intern. Atomic Energy Agency Conf. on Nucl. Data-Microscop. Cross-Sect. and other Data Basic for Reactors, Paris, 17–21 Oct. 1966
(KFK-450; CONF-661014-43; CN-23/7)

The neutron fission cross sections of ^{239}Pu and ^{240}Pu at 5 to 150 keV were obtained by measuring the ^{239}Pu/^{235}U and ^{240}Pu/^{235}U fission cross-section ratios. NSA

N67-28482# Kernforschungszentrum, Karlsruhe (West Germany). Institut fuer Angewandte Kernphysik.
A NOVEL METHOD FOR VERY HIGH RESOLUTION CROSS-SECTION MEASUREMENTS
S. Cierjacks, P. Forti, D. Kopsch, L. Kropp, and H. Unseld Oct. 1966 16 p refs Presented at Intern. Atomic Energy Agency Conf. on Nucl. Data—Microscop. Cross Sect. and other Data Basic for Reactors, Paris, 17–21 Oct. 1966
(KFK-453; CN-23/11; CONF-661014-42)

A neutron time-of-flight spectrometer was put into operation using the Karlsruhe isochronous-cyclotron as a very intense pulsed neutron source. The very high recurrence frequency of the microstructure bunches from the cyclotron was reduced using a novel bunching-deflection system to avoid frame overlap problems while largely preserving the high average neutron intensity available from the internal beam. The performance data of the spectrometer are as follows: flight path 57 m, neutron pulse length 1±0.3 ns full width at half maximum, integrated time averaged neutron flux ($0.2 \leq E_n \leq 50$ MeV) $\phi = (5\pm2)\cdot10^4$ n.cm^{-2}s.$^{-1}$ at 57 m, while using a thick natural uranium target and deuterons of (45±5) MeV. With the present flight path a maximum resolution of 0.02 ns/m was determined for the spectrometer. The time-of-flight apparatus and the first total cross-section measurements for some light and medium-weight nuclei in the energy region between 0.5 and 10 MeV are presented. Author (NSA)

N67-28485# Oak Ridge National Lab., Tenn.
CALCULATION OF ENERGY SPECTRA FROM CONTINUOUS PULSE HEIGHT SPECTRA. PART I. PRELIMINARY REMARKS
W. Futtermenger, H. Hoff, S. Sasse, and C. D. Wueneke [1967] 12 p refs Transl. into ENGLISH from German
(ONRL-TR-1511; ABS-THH-1003) CFSTI: HC$3.00/MF$0.65

It is shown how pulse height spectra can be recalculated into energy spectra with the use of influence functions. The investigation refers to γ-spectra with an energy of up to 20 MeV, i.e., bremsstrahlung spectra, reactor spectra and scattering spectra of the most diverse sources. A NaI-scintillation crystal of 4" × 5" is used for which the influence functions are known. The fundamental mathematical formulations concerning the problems considered and instructions for their solution are compiled. The coefficients of the influence matrixes used in practice are developed from known reference spectra. It proves to be suitable to establish a favorable interval division for each of the different spectral forms. The accuracy attained for the energy spectra is reported. It is also shown how the recalculation pulse height spectra to the corresponding energy spectrum can be performed with the aid of a pulse height multichannel analyzer, with a teleprinter, and a few accessories without the use of a large digital computer. Author (NSA)

N67-28490# Kernforschungszentrum, Karlsruhe (West Germany). Institut fuer Angewandte Kernphysik.
CAPTURE CROSS-SECTION MEASUREMENTS FOR SOME MEDIUM AND HEAVY WEIGHT NUCLEI USING A LARGE LIQUID SCINTILLATOR
D. Kompe Oct. 1966 12 p refs Presented at Intern. Atomic Energy Agency Conf. on Nucl. Data-Microscop. Cross-Sect. and Other Data Basic for Reactions, Paris, 17–21 Oct. 1966
(KFK-455; CONF-661014-44)

Neutron capture cross sections for the nuclei Ag, Au, Cd, Cs, Hf, In, Mo, Nb, Pd, Re, Ta, and W were measured in the energy range from 10 to 150 keV using a pulsed van de Graaff generator. A large liquid scintillator was used to detect capture events in the samples. All measurements were based on the capture cross section of Au as a standard. NSA

N67-28491# Kernforschungszentrum, Karlsruhe (West Germany). Institut fuer Angewandte Kernphysik.
AN ABSOLUTE (n,γ)-CROSS-SECTION MEASUREMENT FOR GOLD AT 30 keV AND ITS APPLICATION IN NORMALIZATION OF OTHER DATA
W. Poenitz Oct. 1966 28 p refs Presented at Intern. Atomic Energy Agency Conf. on Nucl. Data-Microscop. Cross-Sect. and Other Data Basic for Reactions, Paris, 17–21 Oct. 1966
(KFK-454; CONF-661014-48)

The Au(n,γ) cross section was measured at $E_{n=30}$ keV using a Au foil irradiated by a collimated beam of neutrons from the $^{7}Li(p,n)^{7}$ reaction at threshold energy. The purpose of the experiment was to find an absolute cross section value in the keV region useable for the normalization of Au(n,γ) cross section curves. A review is given of the methods used for measurement of neutron capture cross sections in the keV region and of the available data on the (n,γ) cross sections for Au, for which there is considerable disagreement in published values. NSA

N67-28493# Brookhaven National Lab., Upton, N. Y.
TRACK FOLLOWING REVISITED
George Rabinowitz 1966 11 p ref Presented at 1967 Intern. Conf. on Programming for Flying Spot Devices, Munich, 18–20 Jan. 1967
(Contract AT(30-2)-GEN-16)
(BNL-11140; CONF-670105) CFSTI: HC$3.00/MF$0.65

Experience with the track following program developed previously has suggested various ways in which the program might be improved. A new program was written which, while similar in over-all approach to the problem, differs in a number of significant respects. Author (NSA)

N67-28523# Columbia Univ., Irvington, N. Y. Physics Dept.
THE ANNIHILATION OF STOPPING ANTIPROTONS INTO K MESONS
Naomi Barash Jan. 1967 101 p refs
(Contract AT(30-1)-1932)
(R-575; CU-1932-261; NEVIS-157) CFSTI: HC$3.00/MF$0.65

This study of the annihilation of antiprotons into K mesons is based on a sample of about 700,000 antiprotons which were stopped in the 30-in. Columbia–BNL liquid hydrogen bubble chamber. Branching ratios into the various final states containing K mesons were measured, and production of the K°, ω, and η resonances was studied. The quantum numbers of some of the final states were determined, making use of symmetry arguments. Predictions of various unitary symmetry schemes are also discussed, and are compared with experimental results. Author (NSA)

N67-28524# Joint Inst. for Nuclear Research, Dubna (USSR).
DESCRIPTION OF ELASTIC NN-SCATTERING IN MESON MODEL OF NUCLEAR FORCES [OPISANIE UPRUGOGO NUKLON-NUKLONNOGO RASSE-YANIYA V MEZONNOI MODELI YADERNYKH SIL]
V. V. Babikov and V. S. Kiselev 1967 16 p refs In RUSSIAN
(JINR-P4-3135)

The phase shifts of elastic NN-scattering with the orbital momenta $L \geq 1$ for the energy range of $E_{Lab} \leq 330$ MeV are calculated on the basis of an assumption that the external region of nuclear forces is determined by the exchange of the lightest π, η, ρ, ω, ε mesons. The momentum dependence of the potentials is calculated in the Born approximation. The constants of meson–nucleon coupling are found which lead to a satisfactory description of experimental P, D,F, G scattering phase shifts. It is shown that these values agree with those of the coupling constants, determined from other experimental data. Author (NSA)

N67-28525# Atomic Energy Centre, Dacca (Pakistan).
PHASE SHIFT CALCULATIONS FOR REAL AND REALISTIC POTENTIALS
Shamsher Ali and Mozaharul Islam Sep. 1966 14 p refs
(AECD/TP/15)

Real and central potentials are considered in the program presented and a procedure for phase shift calculations is developed which can be readily used for all types of realistic potentials. This program also incorporates the calculation of the low-energy effective range parameters, namely, scattering length and effective range. NSA

N67-28526# Los Alamos Scientific Lab., N. Mex.
SINGLE π-PRODUCTION IN π-NUCLEON COLLISIONS
J. E. Young and M. Rich [1966] 27 p refs Presented at 2d Intern. Conf. on High Energy Phys. and Nucl. Struct., Rehovoth, Israel, 1967
(Contract W-7405-ENG-36)
(LA-DC-8617; CONF-670207-2) CFSTI: HC$3.00/MF$0.65

The process $\pi+N \rightarrow 2\pi+N'$ is studied within the framework of simple models of the sort proposed by Amado, et al., and Lovelace. Author (NSA)

N67-28527# California Univ., Berkeley. Lawrence Radiation Lab.
EQUIVALENT-POTENTIAL METHOD FOR RELATIVISTIC SCATTERING
Jerome Finkelstein (Ph.D. Thesis) 26 Jan. 1967 58 p refs
(Contract W-7405-ENG-48)
(UCRL-17311) CFSTI: HC$3.00/MF$0.65

The equivalent-potential method is generalized so as to permit calculation both of multichannel scattering and of certain scattering amplitudes of particles of nonzero spin. It is pointed out that amplitudes calculated by this method have correct dependence upon momentum transfer; it is argued that this feature may make the equivalent-potential method a better approximation to the unitarity iteration than is the N/D method. As examples, the $\pi\pi$, πK, and πN amplitudes are considered. For the first two of these cases it is found that the force due to vector meson exchange is far too small (it is suggested that inelastic effects may be quite important), but that if the input couplings are increased so as to reproduce the vector mesons, then 2^+ mesons are also produced, at roughly the masses of the $f^0(1250)$, $f^0(1500)$, and $K^{**}(1405)$. In the πN case, with the potential given by nucleon and $N^*(1238)$ exchange, there are no free parameters in the calculation. The N^* is then "predicted" at a mass of 1100 MeV. The nonresonant phase shifts also agree in a general way with the results of phase-shift analysis; in particular, the S_{11} scattering length has the correct sign, while N/D calculations produce the wrong sign. It is argued that this result indicates that the force due to iteration of the potential, included in this method but not in N/D calculations produce the wrong sign. It is argued that this result indicates that the force due to iteration of the potential, included in this method but not in N/D, can be important. Author (NSA)

N67-28528# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.

DISPERSION SUM RULES IN THE THEORY OF STRONG INTERACTIONS [DISPERSIONNYE PRAVILA SUMM V TEORII SIL'NYKH VZAIMODEISTVII]

V. A. Matveev, L. D. Solov'ev, B. V. Struminskii, A. N. Tavkhelidze, and V. P. Shelest 1967 58 p refs In RUSSIAN
(JINR-P2-3118)

A detailed review on the dispersion sum rules in the theory of strong and electromagnetic interactions is given. The sum rules considered are based on the usual dispersion relations without using the algebra of currents. Author (NSA)

N67-28529# Ceskoslovenska Akademie Ved, Rez. Ustav Jaderneho Vyzkumu.

ENERGY VARIATION OF THE U-120 CYCLOTRON

J. Dobias, T. Fukatko, A. Hrda, O. Karban, M. Krivanek et al Nov. 1966 21 p refs
(UJV-1640)

The possibility of varying the energy of the U-120 type cyclotron without any additional corrections of the radial gradient of the magnetic field was examined experimentally. The shims were left as they were adjusted formerly for $B_0 = 1.45$ W_b/m^2. The energy of the external deuterons beams was measured by means of semiconductor detectors. It was found that the energy of the external beam can be varied in the range from 12.4 to 14.5 MeV, the corresponding beam intensities are sufficient for most nuclear reaction studies. Author (NSA)

N67-28530# Stanford Univ., Calif. Linear Accelerator Center.

CONCISE ON LINE CONTROL SYSTEM

Sam Howry Oct. 1966 13 p refs Presented at 1967 Spring Joint Computer Conf., Atlantic City, Apr. 1967
(Contract AT(04-3)-515)
(SLAC-PUB-248; CONF-670403-1) CFSTI: HC $3.00/MF $0.65

A small on-line computer system was developed at SLAC to monitor and control magnets and other equipment leading from the accelerator to the experimental areas. NSA

N67-28531# California Univ., Livermore. Lawrence Radiation Lab.

REVIEW OF DYNAMIC INSTABILITIES IN CIRCULAR ACCELERATORS

V. Kelvin Neil 15 Feb. 1967 8 p refs Presented at Natl. Accelerator Conf of 1967, Washington, D. C., 1–3 Mar. 1967
(Contract W-7405-ENG-48)
(UCRL-70205; CONF-670307-6) CFSTI: HC $3.00/MF $0.65

The coherent electromagnetic self-forces of a beam of particles in an accelerator can render unstable the motion of individual particles, or give rise to unstable coherent motion of the beam. Coherent longitudinal bunching of an azimuthally uniform beam can result from the negative mass instability or interaction of the beam with the accelerating cavities. The negative mass instability can be suppressed by a sufficient spread in circulation frequency or by surrounding the beam with appropriate walls. The beam-cavity interaction can be overcome by careful design of the rf system. The interaction of the self-fields with the surrounding walls can lead to unstable coherent transverse motion through the finite resistance of the wall material. This instability may be suppressed by a sufficient spread in betatron frequencies. The relatively slow growth rate also allows stabilization by means of electronic feedback, and the stabilizing effect of passive structures has also been investigated. Experimental and theoretical investigation has led to an understanding of these effects to the extent that accelerators can be designed to overcome the instabilities. Author (NSA)

N67-28532# Paris Univ., Orsay (France). Laborstoire de l'Accelerateur Lineaire.

REPORT OF ACTIVITY OF THE ORSAY COLLISION-RING GROUP, 15 APRIL 1966–15 OCTOBER 1966 [RAPPORT D'ACTIVITE DU GROUPE DE L'ANNEAU DE COLLISIONS D'ORSAY, 15 AVRIL 1966–15 OCTOBRE 1966]

Jan. 1967 18 p refs In FRENCH
(LAL-1167)

Studies on fast injection and the study on the structure and stability of electron beams of several tens of mamp constituted the essential part of the experimental program on the ACO ring. Results were obtained on the current collected by the sweep electrodes or by electrostatic beam separation electrodes. Theoretical studies were made on linear coupling, non-linear betatron oscillations, coherent phase oscillations, and injection in the ACO. The conditions for the utilization of various monitoring reactions were defined more precisely. Most of the results obtained were published at the Symposium International sur les Anneaux de Collisions à Electrons and Positrons, which was held at Saclay, September 26–30, 1966. NSA

N67-28533# Los Alamos Scientific Lab., N. Mex.

PHYSICS WITH MESON FACTORIES

Louis Rosen [1966] 53 p refs Presented at 2d Intern. Conf. on High Energy Phys. and Nucl. Struct., Rehovoth, Israel, 1967
(Contract W-7405-ENG-36)
(LA-DC-8598; CONF-670207-1) CFSTI: HC $3.00/MF $0.65

The characteristics of a typical meson factory are indicated using as a reference the LASL machine. A number of the more important uses of a meson factory for basic physics are discussed in some detail including studies of nuclear forces, nuclear structure, nuclear structure studies with mesons (μ), weak interactions, fundamental particle studies, and electromagnetic interactions. NSA

N67-28535# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.

MODERN NUCLEAR FORCE MODELS [SOVREMENNYE MODELI YADERNYKH SIL]

V. V. Babikov 1967 10 p refs In RUSSIAN
(JINR-P4-3136)

Different models of nucleon-nucleon interaction, used in nuclear physics, are discussed. Author (NSA)

N67-28536# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.

CP-VIOLATION AS CONSEQUENCE OF GEOMETRIZATION OF MAXWELL FIELD

B. A. Arbuzov and A. T. Filippov 1966 25 p refs (JINR-E2-3089)

The geometric interpretation of the CP-violating interaction which was proposed earlier, is given. The space with vanishing Riemannian curvature, with usual Minkovsky metrics, but with nonvanishing torsion is considered. It is shown, that this space is completely defined by some antisymmetric tensor of the second rank, which is naturally related to the tensor of the electromagnetic field. Simple geometric considerations lead to equations, which generalize the Maxwell equations. It is shown that the spinor particle in this space certainly has the CP-violating interaction. Author (NSA)

N67-28537# Technische Hochschule Stuttgart (West Germany). Institut fuer Kernenergetik.

SCATTERING OF LOW ENERGY NEUTRONS IN ZIRCONIUM HYDRIDE [STREUUNG LANGSAMER NEUTRONEN IM ZIRKONHYDRID]

B. Roehrborn Dec. 1966 53 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Wiss. Forschung, Bad Godesberg, West Germany

(BMWF-FBK-66-40)

Calculations are made of neutron scattering in zirconium hydride taking into account the chemical binding of the hydrogen atom in the crystal system. It is shown how this can be done based on theory developed by Zemach and Glauber. The spectrum of the crystal frequency distribution is approximated as proposed by Nelkin and Rosenbluth. Calculations are compared with neutron scattering experiments by Parfenov (Dubna) and the experimental results by Pan and Webb (Troy, N. Y.). Some parameter studied were done in order to prove the applicability of Nelkin's model for the calculation of neutron flux distribution in zirconium hydride. With some of these parameters, which are consistent with crystal physics, the qualification of this model for neutron spectra in zirconium hydride is demonstrated. Calculations were compared with experimental neutron spectra given by Beyster et al. Author (NSA)

N67-28538# California Univ., Berkeley. Lawrence Radiation Lab.

DETERMINATION OF THE NEUTRON–NEUTRON SCATTERING LENGTH

Edward Shield (Ph.D. Thesis) 19 Dec. 1966 72 p refs (Contract W-7405-ENG-48)

(UCRL-16864) CFSTI: HC $3.00/MF $0.65

Measurements on the reaction Tf(d,^{3}He)2n at 32.7-MeV incident deuteron energy were used to determine the n–n scattering length. Watson's theory of final-state interactions provides a theory with which the experimental data giving the number of ^{3}He at 6° and 8° vs energy can be compared. Comparison is made with numbers of ^{3}He near the maximum energy, in which case the neutrons go off with little relative energy under the influence of a final-state s-wave interaction. The best fit of the data to theory gives $a_{nn}=-16.1\pm0.1$ F. The applicability of this method is proved by measurements on the reaction ^{3}He(d,t)2p, which give a value for a_{pp} equal to the accepted value within the experimental errors. Comparisons of the results with other measurements of a_{nn} are given. Author (NSA)

N67-28539# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions.

IDENTIFICATION OF ^{111}Te BY DAUGHTER ISOTOPES OF PROTON DECAY [IDENTIFIKATSIYA ^{111}Te PO DOCHERNIM PRODUKTAM PROTONNOGO RASPADA]

D. D. Bogdanov, I. Bacho, V. A. Karnaukhov, and L. A. Petrov 1967 12 p refs In RUSSIAN

(JINR-P6-3138)

In order to identify a delayed proton emitter ($T_{1/2}\approx 19$s), produced by the reaction ^{102}Pd+^{12}C, the radioactive products of its decay were investigated. To separate these products from the enormous background of γ activity, which is due to other reaction channels, the fact was used that in proton decay the daughter isotopes have a considerable recoil energy. The background is due to the adsorption of the activity on the surface of the cather. This background was practically reduced by means of removing thin layers, 1.5 to 2.0 μg/cm^2, from the surface of an aluminum cather. In the γ spectrum of recoils the peaks are singled out at the energies 290±27 and 650±28 keV. The half lives of these activities are 3.6±0.6 and 4.0±1.0 hr, respectively. The emission is ascribed to ^{110}Sn and ^{110}In isotopes which are the decay products of ^{111}Te—the delayed proton emitter. Author (NSA)

N67-28552# Aerospace Research Labs., Wright-Patterson AFB, Ohio.

TABLE OF HARTREE-FOCK SELF CONSISTENT FIELD WAVE FUNCTIONS WITH EXCHANGE, SUPPLEMENT III, NOVEMBER 1965–DECEMBER 1966

T. K. Krueger, W. L. McDavid, and S. J. Czyzak Jan. 1967 323 p refs

(ARL-67-0014, Suppl. III; AD-651072) CFSTI: HC $3.00/MF $0.65

A table is presented of the Hartree–Fock wave functions for various atoms and ions mainly of astrophysical interest having atomic numbers ranging from 3 to 80. Also included in the table are the one-electron energy parameters and the relativistic and spin–orbit energy corrections. Author (TAB)

N67-28583# Atomic Energy Commission, Washington, D. C. Div. of Technical Information.

THREE-BODY PROBLEM. COMPLETE SYSTEM OF ANGULAR FUNCTIONS [ZADACHA TREKH TEL. POLNAYA SISTEMA UGLOVYKH FUNKTSII]

Yu. A. Simonov 1965 18 p refs Transl. into ENGLISH from Russian

(AEC-TR-6835; ITEF-384)

The wavefunction of three particles depends on two vectors—the relative coordinates or momenta of the particles—and must be a representation of the permutation group of three particles. A method is proposed for constructing the complete system of functions for each value of the total angular momentum L, these functions being the irreducible representations of the permutation group. For L=0 the functions are deduced and written explicitly. They are noted by the values of K—the global six dimensional angular momentum, K being any positive even number, and by ν, going from −K/2 to K/2 with the interval of two. Symmetric and antisymmetric functions are those with ν multiple of three. Author (NSA)

N67-28584# Brookhaven National Lab., Upton, N. Y.

STUDIES OF BEAM BEHAVIOR IN THE ENERGY REGION OF 50 TO 400 MeV WITH THE BROOKHAVEN ALTERNATING GRADIENT SYNCHROTRON

A. van Steenbergen 1966 12 p refs Presented at Natl. Particle Accelerator Conf., Washington, D. C.

(Contract AT(30-2)-GEN-16)

(BNL-11141; CONF-760307-21) CFSTI: HC $3.00/MF $0.65

The "fast kicker" of the Brookhaven AGS, normally used for orbit perturbations at high energy as part of the fast ejected beam system is used to eject the circulating proton beam in the energy region of 50–400 MeV. Beam behavior in the early part of the acceleration cycle is studied by measuring the ejected beam vertical phase space emittance and density distribution. Effective phase space dilution and beam intensity dependent effects have been observed. The observed distributions are consistent with a four or six dimensional gaussian distribution. Author (NSA)

N67-28585# Brookhaven National Lab., Upton, N. Y.
IMPROVED CALCULATIONS OF PROPERTIES OF THE SLOW EXTRACTED BEAM
M. Q. Barton and J. Faure 3 Feb. 1967 19 p refs
(Contract AT(30-2)-GEN-16)
(BNL-11169) CFSTI: HC $3.00/MF $0.65

Using the CDC 6600 version of BEAM, improved calculations were made for slow beam extraction from the AGS starting with a procedure for finding unstable fixed points and then following unstable trajectories through the system, ejector, and even the fringing field until the trajectories are completely free of the accelerator. A description is given of the mathematical method, followed by a discussion of the results. It is concluded that the calculations confirm the preliminary estimates used to establish design parameters for the hardware constructed for the beam. Some future developments are mentioned. NSA

N67-28586# Brookhaven National Lab., Upton, N. Y.
BEAM EXTRACTION FROM THE PROTON SYNCHROTRON
M. Q. Barton [1967] 11 p refs Presented at the Natl. Particle Accelerator Conf., Washington
(Contract AT(30-2)-GEN-16)
(BNL-11102; CONF-670307-8) CFSTI: HC $3.00/MF $0.65

A review is given of the fast beam extraction systems developed for the Brookhaven and CERN machines. The use of the third integral resonance in the slow extraction system being developed at Brookhaven is described and compared with the slow extraction system at CERN. The future of external beams for AG proton synchrotrons and considerations for the 200 GeV machines are discussed. NSA

N67-28590# Kernforschungszentrum, Karlsruhe (West Germany). Institut fuer Experimentelle Kernphysik.
MEASUREMENT OF THE β-γ CIRCULAR POLARIZATION CORRELATION IN ALLOWED β TRANSITIONS [MESSUNG DER β-γ-ZIRKULARPOLARISATIONSKORRELATION AN ERLAUBTEN β-UEBERGAENGEN]
H. Behrens Jun. 1966 169 p refs In GERMAN
(KFK-434)

With a new type of apparatus used for the measurement of the β-γ circular polarization correlation in which the magnet was used not only as a scattering magnet for the circularly polarized γ quanta but also as a β spectrometer, a quadrupling of the installation could be obtained with respect to the conventional types of apparatus and the statistical and systematic errors could be greatly reduced. The analyzer efficiency was calculated with all correctors and a control. The asymmetry coefficients of the β-γ circular polarization correlation of ^{110}Ag, ^{41}Ar, ^{47}Ca, ^{134}Cs, ^{56}Co, ^{58}Co, ^{60}Co, ^{52}Mn, ^{56}Mn, ^{22}Na, ^{24}Na, ^{46}Sc, and ^{48}V were determined. Author (NSA)

N67-28597# Illinois Univ., Urbana.
A STUDY OF THE p p π^+ π^- FINAL STATE IN 8-GeV/c p-p INTERACTIONS
D. Grether, G. Ascoli, M. Firebaugh, E. L. Goldwasser, R. D. Sard et al 1966 12 p refs Presented at N. Y. Meeting of the Am. Phys. Soc., 30 Jan.-2 Feb. 1967
(Contract AT(11-1)-1195)
(COO-1195-78; CONF-670109-71) CFSTI: HC $3.00/MF $0.65

The preliminary analysis of the four-body final state pp$\pi^+\pi^-$ from p+p interactions at 8 GeV/c is reported. The dominant characteristic of this final state is the strong production of the N* ++(1236). This strong production is shown in a Chew-Low plot of the mass of the pπ^+ combination versus the square of the four-momentum transfer to the pπ^+. Invariant mass plots are also shown. NSA

N67-28598# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy.
THE SEARCH FOR THE NUCLEON ISOBAR WITH T=5/2 IN np-INTERACTIONS [POISKI NUKLONNOI IZOBARY S T=5/2 V np-VZAIMODEISTVIYAKH]
V. F. Vishnevskii, V. I. Moroz, A. V. Nikitin, and Yu. A. Troyan 1967 8 p refs In RUSSIAN
(JINR-P1-3146)

The distributions are given on effective masses of p$\pi^+\pi^+$ and n$\pi^-\pi^-$ combinations for 114 cases of np→pn$\pi^+\pi^+\pi^-\pi^-$ and np→pn$\pi^+\pi^+\pi^-\pi^-\pi^0$ reactions produced by bombarding a 24-liter propane bubble chamber with 2-10 GeV neutrons. In these distributions the enhancements are pointed out in the mass region from 1600 up to 1170 MeV/c^2 which differ from background curves by three standard deviations. Author (NSA)

N67-28687# Northwestern Univ., Evanston, Ill. Gas Dynamics Lab.
ARGON ELECTRON TRANSITION TABLES Interim Technical Report, Dec. 1965-Dec. 1966
A. E. Wright, Jr., D. L. Evans, R. S. Tankin, and A. B. Cambel Wright-Patterson AFB, Ohio, ARL, Jan. 1967 379 p refs
(Contract AF 33(615)-1160)
(ARL-67-0016; AD-651077) CFSTI: HC $3.00/MF $0.65

Electron transition data for argon (atom through the seventh ion), for wavelengths between 0 and 10,000 Angstrom units, is presented. Corrections in the wavelength of the transitions to account for air at atmospheric pressure have been made for transitions above 2,000 A. Author (TAB)

N67-28701# International Centre for Theoretical Physics, Trieste (Italy).
SUM RULES AND THE ELECTROMAGNETIC ISOBAR-NUCLEON CURRENT
C. G. Bollini (Fundacion Bariloche, Buenos Aires) and J. J. Giambiagi Intern. Atomic Energy Agency, 3 Mar. 1967 10 p refs Submitted for publication
(IC-67-11) CFSTI: HC $3.00/MF $0.65

A sum rule for the isovector form factor and experimental results on photoproduction, are used to determine the coupling constants of the N_{33}-nucleon electromagnetic current. A brief discussion of some previous calculations is included. Author (ESRO)

N67-28764*# Maryland Univ., College Park.
ATOMIC SPECTROSCOPY WITH THE SHOCK TUBE
T. Wilkerson, D. Koopman, N. Miller, R. Bengtson, and G. Charatis May 1967 30 p refs Presented at 6th Intern. Shock Tube Symp., Freiburg, W. Germany, 12-14 Apr. 1967 Submitted for publication
(Grant NsG-359)
(NASA-CR-84796; BN-508) CFSTI: HC $3.00/MF $0.65 CSCL 20H

Transition probabilities for lines of light atoms and ions are measured with a gas-driven shock tube in the temperature range 9000°-13000°K. A set of experiments on one element is given, including recent developments in circumventing the sensitive dependence of level populations on temperature. The shock tube and observing instruments are described. The elements are introduced in gaseous additives to the carrier gas which is usually neon. Computer programs provide the details of ionization-excitation equilibria based on measured temperatures and pressures, and also a comparison of these measurements with Rankine-Hugoniot theory. Given a spectral line intensity, the associated transition probability is determined from the measured thermal quantities. Redundant temperature measurements greatly reduce the random and systematic errors. Preliminary results are given for visible lines of neutral carbon. Spectra of other light elements are also presented and discussed. Author

N67-28801# International Centre for Theoretical Physics, Trieste (Italy).

λ-P SCATTERING AND λ-N INTERACTION

M. E. Grypeos, Shamsher Ali, and L. P. Kok Mar. 1967 16 p refs

(IC-67-16) CFSTI: HC $3.00/MF $0.65

On the effective range approximation, an analysis is made of the available λ-p scattering data using Yukawa λ-N interactions, including the purely attractive ones as well as those with a hard core. The analysis indicates the appropriateness of a value of the intrinsic range of the λ-N interaction, approximately that suggested by the one-boson exchange model (boson mass ≥100 MeV). Singlet and triplet λ-N potentials are also derived and discussed. Author (ESRO)

N67-28842 Tokyo Univ. (Japan). Dept. of Physics.

NONLEPTONIC HYPERON DECAY IN THE QUARK MODEL

Kimio Miura and Toshiyuki Minamikawa [1967] 21 p refs

(TUEP-67-7)

Nonleptonic hyperon and Ω^- decays are discussed in the nonrelativistic quark model and SU(6) theory. Consideration is given to the pole diagram for quark, the four-body weak current–current interaction, and the meson exchange interaction. Two models are formulated, and experiments for parity violating and parity conserving amplitudes of nonleptonic hyperon decays are described. In particular, $\Delta I = 1/2$ rule is derived, though the weak current–current interaction does not satisfy. It is pointed out that the nonrelativistic model seems to provide a fairly satisfactory explanation for nonleptonic decays and especially for branching ratio of Ω^- decay. Author

N67-28845# Istituto Superiore di Sanita, Rome (Italy). Laboratori di Fisica.

INTRODUCTION TO RADIATION PHYSICS. CHAPTER V: MODERN PHYSICS AND ATOMIC STRUCTURE [INTRODUZIONE ALLA FISICA DELLE RADIAZIONI. CAPITOLO V: LA FISICA MODERNA E LA STRUTTURA ATOMICA]

U. Amaldi, Jr. 10 Jan. 1967 77 p In ITALIAN; ENGLISH summary

(ISS-67/1) CFSTI: HC $3.00/MF $0.65

A series of reports devoted to an introduction to relativity and quantum mechanics is presented. Some phenomena that are not explained in the framework of classical physics are described and from them the two quoted arguments are developed. An elementary presentation of the indetermination principle and of the wave and corpuscular nature of radiations is followed by a discussion of the stability and structure of atoms. Author

N67-28847# United Kingdom Atomic Energy Authority, Harwell (England). Electronics and Applied Physics Div.

THE MEASUREMENT OF W, THE AVERAGE ENERGY TO PRODUCE AN ION PAIR, FOR RECOIL NUCLEI IN CARBON DIOXIDE

J. W. Leake Jan. 1967 28 p refs

(AERE-R-5130) HMSO: 4d

This report presents preliminary measurements of W, the average energy required to create one ion pair in a gas, for carbon and oxygen recoil nuclei produced by the elastic scattering of neutrons in carbon dioxide gas. The observations cover a range of recoil energies, from 100 kev to 2.9 Mev, for which there is no published data. The accuracy of the present observations is not high and in fact the results are thought to be 10–20% higher than the true values because of the effects of columnar recombination. Three semi-theoretical expressions relating the value of W to the energy (or velocity) of the ionizing particles are discussed and compared with the published experimental data for argon and the present results for carbon dioxide. Author

N67-28848# United Kingdom Atomic Energy Authority, Culham (England). Research Group.

H-FUNCTIONS IN RESONANCE-RADIATION TRANSFER THEORY

V. V. Ivanov and D. I. Nagirner 1967 19 p refs Transl. into ENGLISH from Astrofiz., Akad. Nauk Armyanskoi SSR (USSR), v. 1, no. 2, Jun. 1965 p 143–166

(CLM-TRANS-9) HMSO: 2s 6d

The transfer of radiation in a Doppler broadened resonance line is investigated. A semi-infinite atmosphere is considered with negligibly small absorption in the continuous spectrum, using the approximation of complete frequency redistribution. The intensity of the emergent radiation is expressed by the corresponding H-function. Five-figure tables of $H(z,\lambda)$ are given for a wide range of values of the parameter λ. Special attention is given to values of λ close to unity. The asymptotic behavior of $H(z,\lambda)$ for $z >> 1$ is investigated. It is shown that for $z >> 1$ the function $H(z,\lambda)$ does not depend on z and λ separately but only on a combination of z and λ. The accuracy of the asymptotic expressions and their ranges of validity are discussed. It is found that the region of validity is fairly wide, while the accuracy is sufficiently high to make their use practical. Author

N67-28849# United Kingdom Atomic Energy Authority, Culham (England). Research Group.

TRANSFER OF RADIATION IN A SPECTRAL LINE

V. V. Ivanov 1967 24 p refs Transl. into ENGLISH from Tr. Astron. Observ. (Leningrad), v. 22, p 44–65

(CLM-TRANS-10) HMSO: 3s

Theories on radiation transfer in a spectral line are reviewed, and various methods of solving the transfer equation are assessed. Attention is focused on determining those properties of the solutions which might facilitate its numerical solution and improve the accuracy of the approximate methods. Simplifications in the structure of the radiation field are investigated which occur when true absorption plays only a small part, since then the act of photoexcitation of the atom is almost invariably followed by a spontaneous transition, i.e., reradiation of the quantum takes place. The problems considered include (1) light scattering in an idealized medium occupying the half-space bounded by a plane; (2) the probability of the escape of a quantum from great depths for cases in which true absorption is essentially absent, i.e., when it can be assumed that $\lambda = 1$; and (3) a characteristic simplification which arises in the structure of the radiation field when the survival probability of a quantum λ differs only slightly from unity. A reference bibliography is included. M.G.J.

N67-28870# Nuklearni Institut Jozef Stefan, Ljubljana (Yugoslavia).

IDENTITIES, INFINITE CONDUCTIVITY AND MEISSNER EFFECT OF ELECTRON–PHONON GAS

L. Picman Dec. 1966 10 p refs

(NIJS-R-496) CFSTI: HC $3.00/MF $0.65

Some identities are derived among self-energy parts for electrons and phonons and the two kernels which enter the coupled system of linearized kinetic equations. These identities are consequence of conservation laws for number of electrons and momentum of the system. Simple graphical rules are found how to satisfy these identities. A system of linearized kinetic equations with generalized kernels for electron–phonon gas is derived by properly treating the Bethe–Salpeter equation of quantum statistics and the Peierls result, which gives infinite conductivity, is reproduced. The equivalence between Meissner effect and infinite conductivity is demonstrated in the absence of transverse collective excitation. At the same time the explicit criterium for appearance of both effects is given in terms of one particle Green's function. At the end previous results are discussed using the Nambu two-component notation of superconductivity. Author

N67-28871# Kyoto Univ. (Japan). Research Inst. for Fundamental Physics.
COARSE-GRAINED QUANTITIES IN APERIODIC SYSTEM. II: FREQUENCY SPECTRA OF APERIODIC CHAINS
Hirotsugu Matsuda and Naofumi Ogita Jan. 1967 27 p refs
(RIFP-60) CFSTI: HC $3.00/MF $0.65

As an application of the general properties of coarse-grained quantities of aperiodic systems, the method of ensemble average of periodic systems (MEAPS) is discussed for obtaining frequency spectra of aperiodic systems. Histograms of frequency spectra of isotopically disordered diatomic linear chains for various sets of long range and short range order parameters were calculated by MEAPS, and were compared with the result calculated by the negative-factor-counting (NFC) method. It was numerically shown that the suitable choice of the width of histograms is very important for the result of MEAPS to be a good approximation; the choice can be done referring to the stability of the histogram with change of the ensembles. The comparison then indicates that MEAPS using periodic chains with not more than 8 atoms in a unit cell gives better approximation than the moment method using 20 moments. Although for the spectra of one-dimensional systems NFC is a better method than MEAPS, the latter has a wider range of applicability so that the result of this study may lend support for the investigation of more complicated quantities or systems by this method. Author

N67-28938*# Field Emission Corp., McMinnville, Oreg.
INVESTIGATIONS OF ELECTRON EMISSION CHARACTERISTICS OF LOW WORK FUNCTION SURFACES Quarterly Report, 28 Sep.–27 Dec. 1966
L. W. Swanson, A. E. Ball, I. C. Crouser, and B. E. Evans Feb. 1967 32 p refs
(Contract NASw-1516)
(NASA-CR-84875; QR-1; Rept.-1) CSCL 20M

A field emission study of cesium and fluorine coadsorbed on tungsten is reported. Work function minima as low as 1.0 eV are reported along with the effect of coadsorbed fluorine on the migration and desorption rates of cesium. Although cesium can be thermally desorbed throughout most of the coverage range from a fluorinated tungsten surface without disturbing the underlying fluorine layer, there is evidence that at low cesium coverages thermal desorption of cesium enhances the removal of the otherwise stable fluorine layer. Also reported is a study of the mechanisms leading to decay of field emission current from a low work function zirconium/oxygen coated tungsten emitter. The results obtained thus far indicate electron induced desorption of neutral and ionic particles from anode surfaces, which impinge on the emitter surface, as the main cause of the time decay of field emission current. Author

N67-28942# Brussels Univ. (Belgium).
RESEARCH ON NON-EQUILIBRIUM STATISTICAL PHYSICS Final Report
I. Prigogine 31 Oct. 1966 31 p refs
(Contract AF-EOAR-64-52)
(AFOSR-67-0927; AD-651069) CFSTI: HC $3.00/MF $0.65

The research covered by the present report ranges over a large variety of topics. The introduction of a quasi-particle description has been shown to lead to a great formal simplification of the generalized kinetic equations, and of the expression for the non-equilibrium entropy; specific systems studied include anharmonic solids, classical gases, plasmas and many-fermion systems. The general relation between the equilibrium Gibbs definition and the non-equilibrium Boltzmann definition of entropy has been elucidated, and the resulting picture departs quite radically from the disorder or information theory image of entropy. The study of gravitational systems has led to a new type of long time evolution equation with interesting properties. The theory of unstable plasmas has been extended to the inhomogeneous case, and to situations with an external magnetic field. Further progress in plasma physics bears on the study of the generalized dielectric constant and of Cerenkov radiation. The hydrodynamical equations for a relativistic system have been derived from a statistical description, and exhibit novel features. Of particular significance is the progress achieved in setting up a covariant formulation of relativistic statistical mechanics. Finally the thermodynamical theory of the local potential has been applied to the study of the Soret effect, and has been extended to include the stability analysis of simple kinetic equations. Author (TAB)

N67-28967# Naval Radiological Defense Lab., San Francisco, Calif.
STRUCTURE IN THE TOTAL ^{24}Mg(n,p), ^{27}Al(n,p), and ^{27}Al(n,α) CROSS SECTIONS FROM 12 TO 15 MeV
J. M. Ferguson and J. C. Albergotti 15 Feb. 1967 28 p refs
(USNRDL-TR-67-21; AD-649987) CFSTI: HC $3.00/MF $0.65

The relative cross sections of the ^{24}Mg(n,p), ^{27}Al(n,p), and ^{27}Al(n, alpha) reactions were measured with accuracies of a few per cent of better. All three excitation functions fluctuate with periods of the order of a few hundred kilovolts and magnitude of a few per cent. The observed structure is consistent with the Ericson theory. Author (TAB)

N67-28976# Illinois Univ., Urbana. Department of Physics.
A REGGE–QUARK MODEL OF HADRON SCATTERING
P. B. James and R. K. Logan [1967] 10 p refs
(Contract N00014-66-C0010-A05) CFSTI: HC $3.00/MF $0.65

One of the unique features of the quark model is that one obtains relationships between baryon-baryon cross sections and meson-baryon cross sections. A Regge quark model analysis was recently performed in which agreement between these relations and experiment was obtained only after a scale factor was introduced (N. Ahmadzadeh, Phys. Letters v22 p96 1966) in the N-N amplitude. It is now shown how this agreement may be obtained without introducing such a factor. TAB

25 PHYSICS, PLASMA

Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

N67-27801# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy). Laboratorio Gas Ionizzati.
DYNAMICS OF CYLINDRICAL PLASMA SHELLS
J. B. Somon Nov. 1966 57 p refs Sponsored in part by EURATOM
(LGI-66-11) CFSTI: HC $3.00/MF $0.65

Studies of the dynamics of a cylindrical heavy plasma shell, called linear, under electrical acceleration, and the behavior of a compressed central magnetic field or deuterium plasma contained by the inertia of the heavy liner are presented. The efficiency of the energy transmission from liner to plasma and the confinement factor in a marginally confined reactor are determined on the assumptions that the liner is perfectly conducting, that it behaves as a perfect gas and does not radiate, and that pressure on the outer wall of liner equals zero. The experiment is conducted in cylindrical geometry but the case of plane geometry is considered separately. The results corresponding to the compression of an axial magnetic field are extended to the compression of an adiabatic plasma. ESRO

N67-27802# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy). Laboratorio Gas Ionizzati.

TURBULENT DIFFUSION DUE TO DRIFT INSTABILITY DRIVEN BY A TEMPERATURE GRADIENT

A. Cavaliere, B. Coppi (Princeton Univ.) and F. Engelmann Nov. 1966 28 p refs Presented at EURATOM Symp. on Theoret. Plasma Phys., Varenna, Italy, 1966 Sponsored in part by EURATOM

(LGI-66-12) CFSTI: HC $3.00/MF $0.65

The diffusion process induced by unstable modes due to the presence of a temperature gradient in a plasma is investigated in the frame-work of an initial value problem. The diffusion coefficients of both ions and electrons in ordinary and velocity space are calculated in terms of the spectrum of fluctuating electrostatic energy using the quasi-linear theory. The consequences of some choices for the spectrum are considered. In particular, conditions under which the diffusion coefficients may be affected by a small amount of magnetic shear, are discussed. The macroscopic implications of the diffusion are studied, using the equations of motion for the moments of the particle distribution functions. It is shown that quasi-linear diffusion alone can stabilize an initially unstable situation for a small relative variation of the temperature only. Otherwise the diffusion in a possible steady state depends essentially on mode coupling effects and, hence, is difficult to estimate properly. Author (ESRO)

N67-27804# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy). Laboratorio Gas Ionizzati.

RELATION BETWEEN THE FUNDAMENTAL MODES, WITH AND WITHOUT MAGNETIC SHEAR, OF THE DRIFT INSTABILITY DRIVEN BY A TEMPERATURE GRADIENT

B. Coppi (Princeton Univ.) and F. Engelmann Feb. 1967 20 p refs Sponsored in part by EURATOM

(LGI-67-3) CFSTI: HC $3.00/MF $0.65

The possibility of using the Rudakov–Sagdeev modes, representing unstable normal modes for a plasma with a temperature gradient in the absence of magnetic shear, in cases where there is a small, but finite shear, is discussed. Their relation to the localized modes, appearing if magnetic shear is present, is considered. It is shown, that the description by Rudakov–Sagdeev modes is adequate only if the characteristic shearing length is some orders of magnitude larger than the typical length of the temperature gradient. Author (ESRO)

N67-27900 Royal Aircraft Establishment, Farnborough (England).

SOME PROBLEMS OF THE OPERATION OF PLANT HAVING A MAGNETOHYDRODYNAMIC GENERATOR [O NEKOTORYKH VOPROSAKH RABOTY USTANOVOK C MGD-GENERATOROM]

V. A. Kirillin and A. E. Sheindlin Nov. 1966 16 p refs Transl. into ENGLISH from Russian

(RAE-LIB-TRANS-1195)

The most important problem of modern power engineering is to increase the efficiency of thermal and atomic plant for the generation of electric power. This problem is particularly acute in regions with dear fuel. One of the most obvious ways of sharply increasing the initial temperature of the working fluid of a thermal power plant, which determines their efficiency, is to use the magnetohydrodynamic method of transforming heat into electrical energy. This method is also extremely promising in many other cases, for example, in a plant with minimum weight characteristics, and in plant with intermittent action of high power and so on. In this paper an examination is made of some of the problems connected with the problem of creating a power plant with a magnetohydrodynamic generator for open and closed cycles. Author

N67-28230*# Holman (John F.) and Co., Inc., Washington, D. C.

MOTION OF A PLASMA JET ACROSS A NONUNIFORM TRANSVERSE MAGNETIC FIELD [RUKH STRUMENYA PLAZMY KRIZ' NEODNORIDNE POPERECHNE MAGNITNE POLE]

K. D. Sinel'nikov, V. P. Goncharenko, and D. K. Goncharenko Washington, NASA, Jun. 1967 5 p refs Transl. into ENGLISH from Ukr. Fiz. Zh. (Kiev), v. 11, no. 8, 1966 p 825–828

(Contract NASw-1495)

(NASA-TT-F-11016) CFSTI: HC $3.00/MF $0.65 CSCL 20I

Although the long studied conditions of a plasma jet across a uniform magnetic field are simple and predictable, in a nonuniform case the behavior differs from the theoretical. Various examples are given. Experimental observations show that the plasma jet in a gradient field in no way contradicts conclusions in the elementary theory of plasma drift. Author

N67-28232* International Information, Inc., Philadelphia, Pa.

INTERACTION OF THE GLOW FRONT IN AN ELECTRODYNAMIC SHOCK TUBE WITH A TRANSVERSE MAGNETIC FIELD [VZAIMODEYSTVIYE FRONTA SVECHENIYA V ELEKTRODINAMICHESKOY UDARNOY RUBKE S POPERECHNYM MAGNITNYM POLEM]

G. I. Goryaga, A. I. Kokorev, and N. M. Persientseva Washington, NASA, Feb. 1967 9 p refs Transl. into ENGLISH from Vestn. Mosk. Univ. (Moscow), no. 4, 1966 p 3–8

(Contract NASw-1499)

(NASA-TT-F-10626) CSCL 20I

An investigation was made into the nature of the glow front in electrodynamic shock tubes. Experiments on the interaction of the glow front with a transverse magnetic field showed that the glow front corresponds to the leading edge of a plasmoid ejected from the discharge chamber. The shock front becomes visible only after its interaction with some kind of obstacle. Author

N67-28300*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.

RESONANT FREQUENCIES OF A DIELECTRIC SPHERE IMMERSED IN A WARM COLLISIONAL PLASMA

Norman C. Wenger Washington, NASA, Jun. 1967 28 p refs

(NASA-TN-D-4003) CFSTI: HC $3.00/MF $0.65 CSCL 20I

The resonant modes of a dielectric sphere immersed in a warm collisional plasma are determined for various electron densities, electron collision frequencies, and electron temperatures. It is found that variations in the electron density, collision frequency, and temperature cause sufficiently large changes in the resonant frequencies and damping factors of these modes so that a dielectric sphere may be useful as a plasma diagnostic tool. Author

N67-28303# Princeton Univ., N. J. Plasma Physics Lab.

COLLISIONAL DRIFT INSTABILITY IN NON-ISOTHERMAL PLASMAS

H. W. Hendel and P. A. Politzer Feb. 1967 19 p refs Presented at Conf. on Phys. of Quiescent Plasmas, Frascati, Italy, Jan. 1967

(Contract AT(30-1)-1238)

(MATT-507; CONF-670104-3) CFSTI: HC $3.00/MF $0.65

The presence of the collisional drift instability in alkali plasmas was demonstrated. The identification of this instability was aided by the recognition of the effect of a radial electric field, causing a plasma rotation. The principal result of this work is the consistent observation of a single dominant mode for any given set of experimental parameters, and of transitions from one dominant mode to another when magnetic field, plasma density, plasma temperature, or ion mass is varied. Author (NSA)

N67-28315# Michigan Univ., Ann Arbor. Dept. of Nuclear Engineering.
MICROINSTABILITIES IN INHOMOGENEOUS PLASMA Progress Report 1 May 1966–31 Jan. 1967
T. Kammash Jan. 1967 9 p refs
(Contract AT(11-1)-1478)
(COO-1478-2; Rept.-07343-2-P) CFSTI: HC $3.00/MF $0.65

A dispersion equation for electromagnetic oscillations in anisotropic magnetized plasma incorporating density, temperature, and magnetic field gradients was used for investigating these instabilities. The simultaneous effect of gradients on oscillations near integral multiples of the ion cyclotron frequency was investigated. Initial results are presented. NSA

N67-28325# Sperry Rand Research Center, Sudbury, Mass.
STUDY OF PULSE DISPERSION IN PLASMA Final Report, 16 May 1964–30 Sep. 1966
G. Meltz Dec. 1966 31 p refs
(Contract AF 19(628)-4183)
(SRRC-CR-66-48; AFCRL-67-0159; AD-649485) CFSTI: HC $3.00/MF $0.65

Research include: pulse dispersion; longitudinal waves in warm plasmas; diagnostic applications of electroacoustic resonances. Author (TAB)

N67-28356# California Univ., Livermore. Lawrence Radiation Lab.
CALCULATIONS OF TOROIDAL MAGNETIC FIELD CONFIGURATIONS
John Killeen, Harold P. Furth, and Robert P. Freis 10 Jan. 1967 60 p
(Contract W-7405-ENG-48)
(UCRL-50161) CFSTI: HC $3.00/MF $0.65

Several computer programs used to calculate magnetic surfaces in a torus are described. Applications include helically wound stellarators and axially symmetric floating ring devices. Evaluation of the relevant hydromagnetic stability criteria, such as $dV/d\psi$, is included in the calculations. Automatic plotting routines for the graphical display of the surfaces are part of the programs. Fortran listings of the programs are included. Author (NSA)

N67-28374*# Israel Program for Scientific Translations, Ltd., Jerusalem.
THEORY OF TURBULENT PLASMA [TEORIYA TURBULENTNOI PLAZMY]
A. A. Vedenov 1966 101 p refs Transl. into ENGLISH from the book "Itogi Nauki: Fizika Plazmy" Moscow, 1965
CFSTI: HC $3.00/MF $0.65 CSCL 20I

Topical aspects of the theory of turbulent plasma are discussed. Modern methods of plasma description are applied to the investigation of small oscillations and plasma stability, as well as the theory of turbulent nonlinear motions in tenuous high temperature plasma (the theory of wave–particle interactions in plasma, the theory of anomalous diffusion and conductivity, and scattering of electromagnetic waves in turbulent plasma). Author

N67-28488# Polish Academy of Sciences, Warsaw. Inst. of Nuclear Research.
TIME BEHAVIOR OF SPECTRAL LINES AND THE DYNAMICS OF PROCESSES IN THE ROD PLASMA GUN "DP" [ZALEZNOSCI CZASOWE WYSWIECANIA LINII WIDMOWYCH A DYNAMIKA PROCESOW W DZIALE PRETOWYM "DP"]
M. Gryzinski, J. Nowikowski, and S. Suckewer May 1966 28 p refs In POLISH; ENGLISH summary
(INR-719/XVIII/PP)

Time-dependent measurements of spectral line intensities performed on the rod plasma gun, DP, are given and discussed. Conclusions concerning the role of gases leaving the surfaces of the electrodes are drawn. Efficiency for removal of the gas from the gun was determined. Using the data for intensities of spectral lines, concentration of electrons and time behavior of electron temperature were calculated. Electron densities were found to be of the order of 10^{15} cm^{-3} and electron temperatures of the order of 6×10^{4} K Author (NSA)

N67-28489# Polish Academy of Sciences, Warsaw. Inst. of Nuclear Research.
MAGNET PROBE MEASUREMENTS IN A DEVICE WITH THE ROD PLASMA GUN "DP" [POMIARY SONDAMI MAGNETYCZNYMI W UKLADZIE Z PRETOWYM DZIALEM PLAZMOWYM "DP"]
Marek Sadowski and Elzbieta Skladnik-Sadowska May 1966 36 p refs In POLISH; ENGLISH summary
(INR-720/XVIII/PP)

Magnetic probe measurements were made on a plasma generated by a new-type injector—the rod plasma gun DP. Average values of the axial component of a plasma magnetic field and propagation velocities of uncompensated charges outside an outer magnetic field or of plasma blobs in an outer field, as well as time correlations of probe signals with oscillations of the discharge current are given, on the basis of oscillograms from outer probes. A breaking-down process of the rod plasma gun as well as components of a local magnetic field and local components of a current-density vector in a plasma were studied with small inner probes. In the plasma generated by the rod gun there are very substantial azimuthal currents that circulate over large radii according to the space between the gun electrodes. Author (NSA)

N67-28543# Naval Research Lab., Washington, D. C.
CALCULATIONS USEFUL IN THE DETERMINATION OF ELECTRON TEMPERATURE FROM X-RAY CONTINUUM RADIATION EMITTED FROM HIGH TEMPERATURE PLASMAS
Raymond C. Elton and Arlo D. Anderson 31 Mar. 1967 42 p refs
(NRL-6541; AD-651050) CFSTI: HC $3.00/MF $0.65

The results of calculations of the total integrated Bremsstrahlung radiation passing through absorbing foils of beryllium, aluminum, and nickel (as well as aluminum and nickel in combination with carbon (polyethylene)) are presented for various temperatures and a range of useful thicknesses. Such information is necessary in obtaining values for the electron temperature in a plasma from measurements of the soft X-ray continuum emission. The spectral distribution of the transmitted radiation is also presented for use in determining the spectral region observed, thereby avoiding regions of undesirable radiation. An indication of an observable flux level in a typical experiment is given, along with equations suitable for scaling to other plasma conditions, as a further aid in selecting foils for a particular application. Author (TAB)

N67-28588# Polish Academy of Sciences, Warsaw. Inst. of Nuclear Research.
SPECTROSCOPIC PLASMA RESEARCH IN A DEVICE WITH THE ROD GUN "DP". PART I: THEORY OF SPECTROSCOPIC MEASUREMENTS IN PLASMA GUNS [SPEKTRALN BADANIA PLAZMY W UKLADZIE Z DZIALEM PRETOWYM "DP". CZESC I. TEORIA POMIAROW SPEKTRALNYCH W DZIALACH PLAZMOWYCH]
Szymon Suckewer Jun. 1966 54 p refs In POLISH; ENGLISH summary
(INR-717/XVIII/PP)

A detailed theory is presented for spectroscopic measurements of the ion and electron temperatures and plasma density with regard to conditions in the rod plasma gun, DP. Problems of electron temperature measurements have been studied closely, for the

density distributions of excited states of atoms and ions differ from a distribution described by Boltzmann's statistical formula. It is shown that for a certain range of electron temperatures of nonthermal plasma (the departure from thermal equilibrium on account of too small density of plasma) there are some excited levels for which density ratios are given by Boltzmann's formula. The electron temperatures can then be calculated from the chosen excited levels, as in the case of a thermal plasma. Author (NSA)

N67-28589# Polish Academy of Sciences, Warsaw. Inst. of Nuclear Research.

SPECTROSCOPIC PLASMA RESEARCH IN A DEVICE WITH THE ROD GUN "DP". PART II: MEASUREMENTS OF PLASMA TEMPERATURE [SPEKTRALNE BADANIA PLAZMY W UKLADZIE Z DZIALEM PRETOWYM "DP". CZESC II: POMIARY TEMPERATURY PLAZMY]

Sz. Suckewer Jun. 1966 74 p refs In POLISH; ENGLISH summary
(INR-718/XVIII/PP)

Results are presented of measurements of electron and ion temperatures in the rod guns DP-I and DP-II. These measurements were made on the basis of a theory given earlier. The ion temperature measurements from observations along and perpendicularly to the gun axis provided facilities for elimination of correlative axial motions of the plasma. It was observed that T_i grows, together with an increase of an ion charge, but an increment of the initial pressure in a discharge chamber causes a decrease of the ion temperature T_i. The greatest value $T_i = 1.5 \times 10^6$ °K was observed for the initial pressure (of air) $p = 10^{-4}$ torr, but the electron temperatures have not exceeded $T_e = 5 \times 10^4$ °K. Ion and electron temperature distribution plots vs the distance from the gun axis are given. The great differences between the ion temperature T_i and the electron temperature T_e are also discussed. Author (NSA)

N67-28591# Wisconsin Univ., Madison.

RELATED TECHNIQUES IN THERMONUCLEAR RESEARCH

D. W. Kerst 1 Mar. 1967 12 p refs Presented at Natl. Particle Accelerator Conf., Washington, D. C., 1–3 Mar. 1967
(Contract AT(11-1)-1233)
(COO-1233-44; CONF-670307-3) CFSTI: HC $3.00/MF $0.65

Among the aspects of thermonuclear plasma research and accelerator technology which have common techniques and problems is the problem of injection which, in the case of accelerators, is guided by limitations imposed by the Liouville theorem. There are various examples of how this limitation on injection comes into play in the case of some plasma devices. There is an interesting analogy between the topology of phase space for particle accelerators and the topology of coordinate space for lines of force in a plasma containment device such as a toroidal stellarator. There are integral, 1/2-integral, 1/3-integral, 1/4-integral, etc., resonances which can be stimulated by magnetic field errors in plasma-confining devices and which would cause the flux-plot topology to break up into rings of islands for a case where the flux plot has shear. The size of the islands depends upon the type of the multipole field forming the flux plot. Although stellarators are made with twisted or helical multipole windings wound around the major circumferential, they can also be made by sectored multipole magnets rotated between focusing and defocusing positions as in an accelerator. For the quadrupole case, the transfer matrices include only exponentials with real exponents and no sines and cosines such as are found in the accelerator analogy. Author (NSA)

N67-28592# Polish Academy of Sciences, Warsaw. Inst. of Nuclear Research.

CONCEPT OF ROD/MAGNETOELECTRIC/PLASMA GUN: "DP" [KONCEPCJA PRETOWEGE (MAGNETOELEKTRYCZNEGO) DZIALA PLAZMOWEGO "DP"]

Michal Gryzinski May 1966 34 p refs In POLISH; ENGLISH summary
(INR-711/XVIII/PP)

The concept of a device intended for creation of a highly focused stream of hot plasma of densities and temperatures interesting from the point of view of controlled thermonuclear research is given. Solid electrodes of the coaxial plasma gun are replaced by grid electrodes (electrodes "transparent" for the particles) so that the radial motion of particles becomes unlimited, and the strong concentration of particles at the axis of the device can be achieved. Using the one-particle model, the basic relations for perfectly transparent and perfectly smooth electrodes are derived. The question of space charges is briefly discussed. It is also shown that the proper construction of "transparent" electrodes (rod plasma gun) and the properly chosen working conditions make it possible to avert decrease of focusing properties resulting from the rough structure of concrete electrodes. The numerical calculations for the particular construction have been done. Author (NSA)

N67-28593# Polish Academy of Sciences, Warsaw. Inst. of Nuclear Research.

ON THE MOTION OF A CHARGED PARTICLE IN A ROD PLASMA INJECTOR "DP" [RUCH CZASTEK NALADOWANYCH W PRETOWYM DZIALE PLAZMOWYM "DP"]

S. Kulinski Oct. 1966 64 p refs In POLISH; ENGLISH summary
(INR-712/VII/PP)

The electric and magnetic field distributions in a rod plasma injector, "DP," is found, and the motion of a charged particle in these fields is considered. The conditions are given for which the ions gain considerable transversal motion energies and there is also the possibility of focusing these ions in the vicinity of the axis. This injector and a coaxial plasma gun with transparent inner electrode are compared. The equations of motion are solved numerically, with the aid of computer GIER for the "DP" device. Author (NSA)

N67-28594# Polish Academy of Sciences, Warsaw. Inst. of Nuclear Research.

AN EXPERIMENTAL DEVICE WITH THE ROD PLASMA GUN "DP" [UKLAD EKSPERYMENTALNY Z PRETOWYM DZIALEM PLASMOWYM "DP"]

Michael Gryzinski, Jerzy Nowikowski, and Marek Sadowski May 1966 28 p refs In POLISH; ENGLISH summary
(INR-713/XVIII/PP)

Details are presented of an experimental device for research of a new-type injector, i.e., the rod plasma gun DP. The construction of the current pulse generator and the shielding arrangement are described. The constructive details of a vacuum system and of an expansion chamber with a gas feeder are also given. An air-core electromagnet that has been used for creation of an outer magnetic field, as well as a control system, are also described. Particular attention is devoted to the description of the plasma gun itself. Author (NSA)

N67-28595# Polish Academy of Sciences, Warsaw. Inst. of Nuclear Research.

CURRENT AND VOLTAGE MEASUREMENTS ON THE ROD PLASMA GUN "DP" [POMIARY PRADOW I NAPIEC PRETOWEGO DZIALA PLAZMOWEGO "DP"]

J. Nowikowski May 1966 26 p refs In POLISH; ENGLISH summary
(INR-714/XVIII/PP)

The circuits for measurements of current and voltage of the rod plasma gun DP are described, and the results of measurements at the pressures in the range 5×10^{-5} to 10^{-1} torr are given. Parameters of the storage bank, equivalent resistance of the gun, and energies delivered to the plasma have been calculated. Times to breakdown of the gun have been also measured. Author (NSA)

N67-28596# Polish Academy of Sciences, Warsaw. Inst. of Nuclear Research.

ANALYSIS OF OPERATION ROD PLASMA GUN "DP" USING METHODS OF RAPID PHOTOGRAPHY [ANALIZA PRACY PRETOWEGO DZIALA PLAZMOWEGO "DP" PRZY POMOCY ULTRASZYBKIEJ FOTOGRAFII]

Michal Gryzinski May 1966 30 p refs In POLISH; ENGLISH summary

(INR-715/XVIII/PP)

Results given of observations of luminosity of plasma in the rod plasma gun DP with a rapid-picture framing camera are given. The pictures confirm theoretical foresights achieved on the basis of the one-particle model. It has been found that plasma is accelerated in the magnetohydrodynamic process at pressures of the order of 10^{-1} mm of Hg and in the magnetoelectric process at pressures of 10^{-2} to 10^{-3} mm of Hg. Jets of plasma in the vicinity of the axis of the gun, characteristic for magnetoelectric acceleration, have been observed. Axial velocities of streams of plasma have been determined. The velocities varied from 10^6 cm/sec at a pressure of 10^{-1} mm of Hg to 5×10^6 cm/sec at 10^{-4} mm of Hg, so that respective energies of axial motions varied from a few eV to some hundred. Throughout all experiments air was used as the working gas. Author (NSA)

N67-28691# Tennessee Univ., Tullahoma. Space Inst.

FULLY DEVELOPED MAGNETOGASDYNAMIC FLOW BETWEEN DIVERGING PLANE WALLS Final Report

William T. Snyder and James R. Maus Arnold AF Sta., Tenn., Arnold Eng. Develop. Center, Apr. 1967 123 p refs

(Contract AF 40(600)-1113)

(AEDC-TR-67-80; AD-651034) CFSTI: HC $3.00/MF $0.65

A solution was obtained to the magnetogasdynamic equations of motion including the effects of compressibility, viscosity, thermal conductivity and crossed electric and magnetic fields. The solution obtained is valid for an acceleration flow in which a separation of variable form of solution is utilized. The constraints under which a separable solution is valid are clearly delineated. The solution is an exact solution in the sense that no terms were dropped from the governing equations and boundary layer approximations were not employed. The results of the investigation were presented in the form of velocity and temperature profiles for several values of the electromagnetic parameters ha and phi. Although the mathematical model used in the present investigation is too crude to be utilized for detailed design of a practical MHD accelerator, it is believed, nevertheless, that the model displays certain qualitative features of the flow which are likely to be encountered in a practical device. Author (TAB)

N67-28838*# Texas Univ., Austin. Plasma Dynamics Research Lab.

PROPAGATION AND DISPERSION OF HYDROMAGNETIC AND ION CYCLOTRON WAVES IN PLASMAS IMMERSED IN MAGNETIC FIELDS Semiannual Status Report, 15 Jul. 1966–14 Jan. 1967

Arwin A. Dougal 15 Jan. 1967 98 p refs

(Grant NsG-353)

(NASA-CR-84833; SASR-8) CSCL 20I

An experimental investigation of ion cyclotron resonance heating of hydrogen and deuterium plasmas in strong magnetic fields is described. The observation of three new plasma phenomena is reported. Investigations were conducted with a spectrum analyzer to measure the frequency spectrum of magnetic probe signals from the plasma. Three effects were observed: (1) frequency mixing of two waves in the general neighborhood of the ion cyclotron frequency to produce sum and difference frequencies, (2) harmonic frequency generation from a propagating wave undergoing harmonic ion cyclotron resonance absorption in the magnetic beach, and (3) dense spectra of frequencies generated in the plasma which appear to be distinct from the harmonic and the sum and difference effects above. The effects appear to be due to nonlinear reactions in the plasma. Author

N67-28846# United Kingdom Atomic Energy Authority, Culham (England). Research Group.

DYNAMICS OF THE PLASMA ENVELOPE OF A NONCYLINDRICAL Z-PINCH UP TO THE INSTANT OF IMPLOSION

Yu. A. Kolesnikov, N. V. Filippov, and T. I. Filippova Dec. 1966 12 p refs Transl. into ENGLISH of I. V. Kurchatov Inst., Moscow, Rept.-18/904, 1966

(CLM-TRANS-8) HMSO: 2s 6d

The initial stage of the formation of a plasma sheet, its structure, and the dynamics of its motion are examined as an extension of studies of pulsed discharges. Experimental investigations were carried out in a pinch chamber with metallic walls. By taking into account Coulomb collisions in determining the conductivity, a relationship was found between the thickness of the skin layer (the dimension of the current-carrying region) and time. Its minimum value was determined and the separation of the discharge from the insulator wall was investigated. Calculations were carried out for a linear dependence of the current on time, assuming a uniform current distribution in the skin layer. Streak photographs were taken to show the motion of the envelope in the radial direction and the motion of the envelope away from the surface of the inner electrode toward the lid of the chamber. The positions of the current envelope calculated at the corresponding instants in time are plotted. Also considered is the motion of the cylindrical part of the current envelope away from the insulator toward the side wall, and the essentially noncylindrical motion upward and toward the axis. S.P.

N67-28858# United Kingdom Atomic Energy Authority, Harwell (England). Electronics and Applied Physics Div.

OPTIMISATION OF MHD GENERATOR PARAMETERS IN AN MHD-REACTOR SYSTEM

G. Rice Feb. 1967 71 p refs

(AERE-R-5030) HMSO: 10s

The report deals with a study of the basic parameters of a magnetohydrodynamic generator related to limits imposed by reactor design. The reactor coolant temperature is considered to be limited to within the range 1600°K to 2000°K. Increased gas pressure normally implies reduced reactor plant size. In an MHD plant however increased gas pressure will result in reduced specific power for which a lower limit of 5 to 10 MW/m^3 is assumed. The theory used assumes extra thermal ionization due to enhanced electron temperature. Computed values of power density and electrical conductivity of the MHD plasma were undertaken for varying magnetic field strength from 1 to 8 Wb/m^2. The noble gases helium and argon with potassium and cesium seeding were considered, for a temperature range of 1010°K to 2000°K and varying 'total head' gas pressure. Plots of the computed results indicate the effect of varying seed ratio, and derived optimum values are related to those of gas discharge experiments. Author

N67-28912# United Aircraft Corp., East Hartford, Conn. Research Labs.

INVESTIGATION TO DETERMINE COLLISION FREQUENCIES OF TYPICAL RE-ENTRY WAKE CONTAMINANTS Final Report, 15 Mar. 1966–14 Mar. 1967

R. H. Bullis and R. J. Andersen 11 Apr. 1967 55 p refs

(Contract DA-31-124-ARO-D-439; ARPA Order 553)

(F-920440-6; AD-650521) CFSTI: HC $3.00/MF $0.65

Electron cyclotron resonance techniques were used to determine the electron-sodium collision frequency in thermally generated sodium plasmas over the temperature range from 1140K to 1390K which corresponds to a mean thermal energy range of 0.098 to 0.120 eV. Over this energy range the effective electron-sodium collision frequency was found to be constant at a value of 5.15 x 10 to the 10th power/torr/sec. Thermochemical calculations of the various species present in the vapor phase for oxygen and nitrogen compounds of sodium indicate that at energies

near 0.1 eV vapors of these materials would be completely dissociated. Therefore, the main contribution to the collision frequency from these materials would be due to the presence of free sodium. Measurements of the electron collision frequency in two component systems which are composed of sodium plus oxygen or sodium plus nitrogen with high overpressures of these gases, so that the predominant collisional broadening is not due to sodium but due to the presence of the second component in the system, are in substantial agreement with the results reported by Engelhardt and Phelps for nitrogen and the results reported by Shkarofsky for oxygen. Author (TAB)

N67-28941# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

CONFINEMENT OF PLASMA IN A TRAP WITH A COMBINED MAGNETIC FIELD

M. S. Ioffe and R. I. Sobolev 17 Mar. 1967 24 p refs Transl. into ENGLISH from *Atomnaya Energ.* (Moscow), v. 17, no. 5, 1964 p 366–375

(FTD-MT-65-305; AD-651089) CFSTI: HC $3.00/MF $0.65

The confining properties of an adiabatic trap with a magnetic field increasing in the longitudinal and radial directions are investigated. Such a field is obtained from the combination of a field of the usual mirror configuration and a field of a system of conductors with current, located in parallel to the axis of the trap. On the basis of the results it is concluded that such a field ensures stable confinement of a plasma, not disturbed by magnetohydrodynamic instability. The decay of the plasma is determined by the charge exchange of fast ions on the residual gas; at most of the attained times of retention comprise 0.06 sec at P = 7 times 10 to the −9th power mm Hg. A qualitative picture of the distribution of the density of the plasma over the radius of the trap is obtained. Author (TAB)

N67-28946# Watervliet Arsenal, N. Y. Benet Labs.

PATH INTEGRALS IN POLAR COORDINATES: CHARGED PARTICLES IN A UNIFORM MAGNETIC FIELD

Akira Inomata Feb. 1967 32 p refs

(WVT-6718; AD-649663) CFSTI: HC $3.00/MF $0.65

The statistical density matrix for a system of charged particles in a uniform magnetic field is derived by Feynman's path integral method. The integrations over all paths are directly carried out by use of cylindrical coordinates. As limiting cases, the density matrices for free particles, rigid rotators, and harmonic oscillators are also discussed. Author (TAB)

N67-28953# Harry Diamond Labs., Washington, D. C.

IMPEDANCE OF WAVEGUIDE SHUNT SLOTS IN PLASMA

John A. Rosadeo, William L. Vault, and Howard M. Bloom Feb. 1967 31 p refs

(HDL-TR-1342; AD-650281) CFSTI: HC $3.00/MF $0.65

Theory and experimental measurements of the impedance of a longitudinal shunt slot radiating into an electrically thick plasma are presented in graphic form. Also included is a computation of the power radiated from the slot under varying conditions of plasma electron concentration and electron collision frequency. Agreement between theory and experiment is quite good considering the difficulties involved with production of stable large volume plasmas. Author (TAB)

26 PHYSICS, SOLID-STATE

Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

N67-27787 Gt. Brit. Ministry of Aviation, London. Technical Information and Library Services.

THEORY OF ELECTRICAL DOMAINS IN SEMICONDUCTORS WITH HOT ELECTRONS [K TEORII ELEKTRICHESKIKH DOMENOV V POLUPROVODNIKAKH S GORYACHIMI ELEKTRONAMI]

V. L. Bonch-Bruevich Jan. 1967 23 p refs Transl. into ENGLISH from Akad. Nauk. SSR. Inst. Radiotekhn. i Elektron. (USSR), 1966 p 1–35

(TIL/T-5710) CFSTI: HC $3.00/MF $0.65

The movement of electrical domains in a state of small supercriticality is studied. Domain movements with several different velocities are confirmed and formulas deduced for the velocity spectrum, field distribution and charge density in the domain. The problem of stability of a spatially homogeneous system with a drift nonlinearity relative to "prime" or "bare" heterogeneities is analysed. Author

N67-27807# United Kingdom Atomic Energy Authority, Harwell (England). Information Branch.

STRUCTURE OF AMORPHOUS GERMANIUM AND SILICON

H. Richter and G. Breitling Jul. 1958 16 p refs Transl. into ENGLISH from Z. Naturforsch. (Tubingen), no. 13a, 1958 p 988–996

(AERE-TRANS-1059) HMSO: 3s

Amorphous vapor-deposited films of germanium and silicon have been examined by means of Cu Kα, MoKα and filtered Ag radiation. The interfering K radiation from germanium was eliminated by means of a silver or palladium foil of thickness 100 or 150 μ. Fourier analysis of the intensity curves gave practically identical atomic distribution curves for all types of radiation. It follows that amorphous germanium and silicon have a layer group structure of (111) planes with thickness about 15 Å. The layers are heavily perturbed, even individually. Layer formation appears to be a general and important feature of the amorphous noncrystalline state. Because of the requirement of continuous space-filling, the groups are joined by transition regions in which the atoms have a largely disordered distribution. When the amorphous vapor-deposited films of germanium are annealed, the ordering at first becomes less, but increases again above 300°C. Unlike arsenic, antimony, and selenium, no formation of crystals in small regions is observed when amorphous germanium is annealed; instead, the transition from amorphous to crystalline occurs suddenly, without the previous formation of small crystallites. From the observed numbers of atoms and distances of first coordination it is concluded that σ_{am}, the density, is about 10% less than σ_{cr} for germanium and silicon. Author

N67-27809# Royal Aircraft Establishment, Farnborough, (England).

THE CONDUCTION BANDS IN 6H and 15R SILICON CARBIDE. PART 2: ABSORPTION MEASUREMENTS

B. Ellis and T. S. Moss Min. of Aviation, Dec. 1966 23 p refs

(RAE-TR-66381) CFSTI: HC $3.00/MF $0.65

It is shown that the free carrier absorption in an uniaxial semiconductor is characterised by two independent absorption coefficients. For a general multivalley model these coefficients are complicated functions of the effective mass and relaxation time tensors but are simplified if the energy extrema are located on the symmetry axis. In this case the anisotropy of the effective mass and also that of the relaxation time may be obtained from the absorption coefficients if these are measured both at high frequencies and also in the low frequency region in the same specimen. At long wavelengths the absorption coefficients approach limiting values as predicted by the theoretical expressions for low frequencies. From these results the effective mass in the direction of symmetry axis was found to be $1.5 \pm 0.2 m_o$ the 6H polytype and $\sim 0.53 m_o$ in the 15R polytype, the relaxation time appropriate to the axial direction was found to be greater than that for the transverse plane by a factor of 2.5 in the 6H form and 1.6 in the 15R form. All results reported relate to room temperature. Author (ESRO)

N67-27810# Royal Aircraft Establishment, Famborough, (England).
THE CONDUCTION BANDS IN 6H AND 15R SILICON CARBIDE. PART 1: HALL EFFECT AND INFRARED FARADAY ROTATION MEASUREMENTS
B. Ellis and T. S. Moss Min. of Aviation, Dec. 1966 22 p refs
(RAE-TR-66380) CFSTI: HC $3.00/MF $0.65

Measurements of infrared Faraday rotation and Hall effect have been made in a number of specimens belonging to the 6H and 15R polytypes of silicon carbide. Within experimental error the Hall coefficient in these samples was found to be isotropic and it is concluded that the conduction band extrema in both polytypes are most probably located on the symmetry axis. For this model the Faraday rotation results give the effective mass appropriate to the directions perpendicular to the axis of symmetry as $0.25 \pm 0.02 m_0$ in the 6H polytype and $0.28 \pm 0.02 m_0$ in the 15R polytype. Considerable care was required to ensure that the specimens used were uniform in carrier concentration and free from serious crystallographic faults; the precautions taken to meet these requirements and in particular the avoidance of one frequently occurring crystallographic imperfection are described in some detail. All the measurements were made at room temperature.
Author (ESRO)

N67-27862 United Kingdom Atomic Energy Authority, Harwell (England). Research Group.
USE OF THE NON-LINEAR ELASTICITY THEORY FOR DEFECTS IN CRYSTALS
A. Seeger and E. Mann Aug. 1966 21 p refs Transl. into ENGLISH from Z. Naturforsch. (Tubingen), v. 14a 1959 p 154–164
(AERE-TRANS-1062) HMSO: 3s 6d

Considered from the continuum point of view, defects in crystals can be described as internal stress conditions with singularities (in some cases also as internal stresses in multiply connected bodies). The present work deals with the systematic application of the nonlinear elasticity theory to such problems. As a result a description is obtained for the conditions in the immediate neighborhood of the defects, in which very great strains can occur. Further, it is possible to describe by the nonlinear theory some effects which in principle cannot be represented by the linear theory. The formalism of the elasticity theory of second order is briefly described, and the experimental determination of the elastic constants of higher order, which here occur, is discussed. Consideration is given to a problem of practical importance, i.e. the determination of the dilatation, which is important for the small-angle scattering of X-rays and neutrons and also for the scattering of the conduction electrons by defects. The method of calculation used is the perturbation calculation based on the linear solution. The explicit and complete solution for the displacement field of a screw dislocation in an isotropic medium is given. The final example as a model for an atom incorporated on an interstitial site, is a sphere forced into a spherical shell with equal elastic constants. It is found for both problems that a general formula applies which was given by Zener for the change in volume resulting from internal stresses in homogeneous media.
Author

N67-27863 United Kingdom Atomic Energy Authority, Harwell (England). Research Group.
NON-LINEAR ELASTICITY THEORY OF STRAIGHT DISLOCATIONS
H. Pfleiderer, A. Seeger, and E. Kroener Aug. 1966 32 p refs Transl. into ENGLISH from Z. Naturforsch. (Tubingen), v. 15a 1960 p 758–772
(AERE-TRANS-1061) HMSO: 4s 6d

The stress function method for the solution of internal stress conditions is developed in a general form, on the basis of the Riemann-Cartan dislocation geometry. The practical calculation of plane internal stress conditions in an isotropic medium is represented in detail in terms of the elasticity theory of second order. Simple relationships are obtained for continuous distributions of straight parallel screw or edge dislocations. With the aid of the formulae obtained, the stress fields of single screw and edge dislocations are calculated in quadratic approximation, which lie at the centers of hollow circular cylinders with stress-free edges. As a supplementary result we obtain the well-known Zener formula for the mean volume expansion with internal stresses from the quadratic elasticity theory.
Author

N67-27871 United Kingdom Atomic Energy Authority, Harwell (England). Research Group.
X-RAY INDUCED LUMINESCENCE IN ALKALI HALIDE CRYSTALS CONTAINING HEAVY HALIDE ION IMPURITIES
J. Valbis Sep. 1966 11 p refs Transl. into ENGLISH from Latvijas PSR Zinatnu Akad. Vestis, Ser. Fiz. Untehnisko Zinatnu (Riga), no. 2, 1965 p 63–71
(AERE-TRANS-1065) HMSO: 1s 9d

X-ray induced luminescence of alkali halide crystals containing small amounts of heavy halide ions as impurities was investigated in the temperature range from 90° to 295°K. It was found that introduction of the heavier I^- and Br^- ions into the crystal lattice causes new luminescence bands to appear (mainly at low temperatures); these are apparently due to transitions in anionic impurity centers. Some most likely models of the impurity centers and their relation to the observed emission bands are discussed on the basis of experimentally determined luminescence spectra and their dependence on temperature and impurity ion concentration.
Author

N67-27873# Nuklearni Institut Jozef Stefan, Ljubljana (Yugoslavia).
MAGNETIC RESONANCE IN HYDROGEN-BONDED FERROELECTRICS
R. Blinc Dec. 1966 82 p refs Submitted for publication
(NIJS-R-493) CFSTI: HC $3.00/MF $0.65

Consideration is given to hydrogen bonded ferroelectrics, and some of the important examples of how magnetic resonance techniques have been used for the study of the ferroelectric state are discussed. Particular attention is given to deuteron resonance and to the problem of the determination of the residence time of a hydrogen at one of the two possible sites in a hydrogen bond. The techniques and applications of deuteron magnetic resonance are discussed, and details are given on DMR spectra and deuteron spin-lattice relaxation. Proton magnetic resonance is also described, and results of deuteron and proton resonance studies of ferroelectric ammonium salts are reported. Investigation of Na^{23} resonance in Rochelle salt is also covered, as well as electron paramagnetic resonance studies in H-bonded ferroelectrics.
L.E.W.

N67-27966# Army Missile Command, Huntsville, Ala. Physical Sciences Lab.
INVESTIGATION OF EXCHANGE EFFECTS IN RUBY BY LINE SHAPE COMPARISONS
Richard L. Hartman, Harry C. Meyer, Jefferson S. Bennett, and Alfred C. Daniel *In* Army Dept. Proc. of the 1966 Army Sci. Conf., Vol. I 26 Aug. 1966 p 437–451 refs (See N67-27941 15-34)
(AD-634688)

Electron paramagnetic resonance (EPR) and ultrasonic paramagnetic resonance (UPR) techniques are discussed, and a comparison of the line shapes obtained by these two techniques shows the UPR as an absorption plot while the EPR as a derivative of the absorption curve. Exchange interaction in ruby indicates that the principal contributors to the line shape are the magnetic dipole interactions between the Cr^{3+} ions, the hyperfine coupling between this type ion and its neighboring aluminum nuclei, and the exchange coupling between neighbors of the ions. Exchange contributions to line shapes are discussed.
M.W.R.

N67-28014*# Stanford Univ., Calif. Solid-State Electronics Labs.
FUNDAMENTAL STUDIES OF THE METALLURGICAL, ELECTRICAL, AND OPTICAL PROPERTIES OF GALLIUM PHOSPHIDE Quarterly Progress Report, Jan. 1–Mar. 31, 1967
31 Mar. 1967 54 p refs
(Grant NsG-555)
(NASA-CR-84660) CFSTI: HC $3.00/MF $0.65 CSCL 20L

The photoelectrical and optical properties of GaP with unfilled cobalt or iron levels is investigated. The amount of iron and cobalt introduced into the sample was much higher than the number of shallow donors present in the sample, thus forming trivalent iron and cobalt in GaP. Another study of properties of rectifying junctions in GaP and $GaAs_xP_{1-x}$ is reported. The specific purpose was to relate the structure of the crystals to the electrical properties of the junctions. Imperfections in vapor grown GaP were examined, and it was concluded that the dominant imperfections were dislocations and stacking faults. Preliminary observations of the diffusion of zinc into GaP were made, and it was found that both types of imperfections appear to act as diffusion short circuits. The behavior of shallow donors in gallium phosphide was investigated. In particular S, Se, and Te were diffused into GaP to determine solubilities and diffusion parameters. Data is used in delineating the properties of GaP doped with these shallow donor impurities.
S.P.

N67-28042# Brookhaven National Lab., Upton, N. Y. Physics Dept.
COMPARISON OF ELECTROMAGNETIC AND NEUTRON STUDIES OF SOLIDS
M. Blume et al *In its* Symp. on Inelastic Scattering of Neutrons by Condensed Systems Mar. 1968 p 1–7 (See N67-28041 15-24)

In a comparison of electromagnetic and neutron studies of solids, the usefulness of the neutron as compared with the usefulness of the photon, is emphasized. This justification is necessary because neutrons are very much more expensive than photons. A number of different experiments involving electromagnetic radiation are briefly considered and compared with neutron scattering experiments.
R.U.

N67-28043# Atomic Energy of Canada, Ltd., Chalk River (Ontario). Nuclear Lab.
REVIEW OF EXPERIMENTAL MEASUREMENTS OF LATTICE MODES IN TRANSITION METALS
A. D. B. Woods *In* Brookhaven Natl. Lab. Symp. on Inelastic Scattering of Neutrons by Condensed Systems Mar. 1968 p 8–15 refs (See N67-28041 15-24)

The measured frequency (ν) versus wave vector (q) dispersion relations for niobium and tantalum are similar to one another, as are those for chromium, molybdenum, and tungsten. It is indicated that the dispersion relations are determined largely by the electronic structure through the electron–phonon interactions. The Δ_1 branch ($\Gamma \rightarrow P \rightarrow H$) has been studied in considerable detail and displays one very striking and other smaller anomalies in both Nb and Mo. It is believed that these anomalies are manifestations of the Kohn effect; their positions correlate well with Fermi surface dimensions deduced from band structure calculations and from direct measurements on tungsten. Measurements on disordered alloys of the two materials indicate that the neutron groups for the phonons are not significantly broader than those for the pure metals, suggesting that the alloys may be treated in the same way as the pure metals but with their own characteristic electronic structure. The altered positions of suspected Kohn anomalies, and the average change in normal mode frequencies, can be correlated, on the assumption of the validity of the rigid band model, with calculations of the band structure and of the density of states for tungsten.
Author

N67-28045# Oxford Univ. (England). Dept. of Theoretical Physics.
IMPURITY AND ANHARMONIC EFFECTS IN NEUTRON SCATTERING BY PHONONS
R. J. Elliott *In* Brookhaven Natl. Lab. Symp. on Inelastic Scattering of Neutrons by Condensed Systems Mar. 1968 p 23–28 refs (See N67-28041 15-24)

The scattering of neutrons by lattice vibrations is very briefly reviewed on the basis of the harmonic approximation to a perfect periodic crystal. Within the harmonic approximation, the introduction of impurities destroys the periodic symmetry. The introduction of anharmonicity leads to a rather different modification. A mathematical expression is presented for the differential coherent cross section, per unit solid angle per unit of outgoing energy per nucleus. The theory of the effect of a single point imperfection on the normal modes of a lattice are also briefly reviewed. Although impurity and anharmonic effects are different in detail, their qualitative form is similar. They change the one-phonon scattering cross sections from delta-functions to lines of a finite width somewhat shifted in position. The tails of these lines have specific shapes and are cut off at the high frequency end. Little experimental evidence is at present available, but preliminary experiments do show that the effects of the general type predicted by the theory are observed.
R.U.

N67-28046# Chalmers Univ. of Technology, Gotoborg (Sweden). Inst. of Theoretical Physics.
ELECTRONIC EFFECTS ON LATTICE VIBRATIONS
Alf Sjolander *In* Brookhaven Natl. Lab. Symp. on Inelastic Scattering of Neutrons by Condensed Systems Mar. 1968 p 24–43 refs (See N67-28041 15-24)

A review of recent work on lattice vibrations in metals and semiconductors is given with particular emphasis on the role played by the valence and conduction electrons. For metals, the effective ion-electron interaction and the screening from conduction electrons is discussed. Atomic vibration is discussed on the basis of the shell model. The various effects are illustrated with figures showing experimental and theoretical results.
Author

N67-28047# Commissariat a l'Energie Atomique, Saclay (France). Service de Physique du Solide et de Resonance Magnetique.
LATTICE DYNAMICS AND PHASE TRANSITIONS
N. Boccara *In* Brookhaven Natl. Lab. Symp. on Inelastic Scattering of Neutrons by Condensed Systems Mar. 1968 p 44–48 refs (See N67-28041 15-24)

The roles of lattice dynamics and entropy in phase transitions are briefly considered. Lattice dynamics in the occurrence of a transition is stressed; the main experimental facts and the most recent theoretical suggestions made to explain those facts are reviewed and new features of the transition predicted.
R.U.

N67-28048# Kyoto Univ. (Japan). Research Inst. for Fundamental Physics.
CRITICAL PHENOMENA
Hazime Mori *In* Brookhaven Natl. Lab. Symp. on Inelastic Scattering of Neutrons by Condensed Systems Mar. 1968 p 49–56 refs (See N67-28041 15-24)

The long-range correlation of spins and anomalous relaxation phenomena in ferromagnets and antiferromagnets near the critical points as typical examples of critical phenomena is discussed. Near the critical point, the correlation of spins becomes of long range. This long-range correlation is the origin of all anomalies observed near the critical point. From this point of view and using a fluctuation-dissipation formula, we discuss how the anomalous relaxation phenomena can be understood, by taking the spin diffusion process and the line width of the electron spin resonance. It is emphasized that neutron scattering experiments on the spin pair correlation and longitudinal damping constant below the Curie point are useful, since their behavior is predicted to be different from that above the Curie point.
Author

N67-28051# Cambridge Univ. (England). Cavendish Lab.
MEASUREMENTS OF THE FREQUENCIES OF THE NORMAL MODES OF MAGNETISM
G. L. Squires *In* Brookhaven Natl. Lab. Symp. on Inelastic Scattering of Neutrons by Condensed Systems Mar. 1966 p 78–82 refs (See N67-28041 15-24)

The normal modes of magnesium have been investigated by means of the inelastic scattering of slow neutrons. The frequencies of about 1000 phonons have been measured with a time-of-flight apparatus, and the values along symmetry directions obtained by an interpolation method. Previous workers have found that their results could be fitted by force models extending to fourth-nearest neighbors or less. The present measurements cannot be fitted by any tensor force model extending only to fourth-nearest neighbors. Author

N67-28052# Laboratoires du Centre d'Etude de l'Energie Nucleaires, Mol (Belgium).
LATTICE DYNAMICS OF NICKEL AND KREBS MODEL
S. Hautecler and W. Van Dingenen *In* Brookhaven Natl. Lab. Symp. on Inelastic Scattering of Neutrons by Condensed Systems Mar. 1966 p 83–87 refs (See N67-28041 15-24)

The lattice dynamics of nickel has been investigated by slow neutron spectroscopy. Phonon spectra have been measured, in the (110) plane, by a time-of-flight technique. The incident monochromatic neutron beam is obtained by Bragg reflection, from a Pb single crystal, of a Befiltered reactor beam. Two hundred phonons were measured under 3 scattering angles (70°, 90°, and 100°). The scattering surfaces and the dispersion curves in the symmetry directions [100], [110], and [111] were deduced from these data. These last experimental results are compared with calculations based on a model proposed by Krebs for face-centered and body-centered cubic metals. A general agreement is found by choosing an appropriate value for the effective number of free electrons. Author

N67-28053# Los Alamos Scientific Corp., N. Mex.
CHARGED BOND CORRECTION TO THE DISPERSION CURVES OF DIAMOND
John L. Warren *In* Brookhaven Natl. Lab. Symp. on Inelastic Scattering of Neutrons by Condensed Systems Mar. 1966 p 88–93 refs (See N67-28041 15-24)

Phonon dispersion curves in the [100] and [111] directions for diamond have been measured previously and reported. These curves are fitted fairly well by a second neighbor Born–von Karman model. A really good fit to the data, however, requires at least fifth neighbors. It is known from x-ray diffraction studies that the electron charge distribution in diamond is nonspherically symmetric about the carbon nuclei. A small amount of charge is concentrated along the bonding directions. In an attempt to explain the long-range contribution to the dispersion curves, the electrostatic contribution to the dynamical matrix was calculated from a negative point charge constrained to remain midway between nearest neighbors. A compensating positive point charge was placed on the carbon atoms. The square of the amount of charge in the bond, Z^2, was left as a parameter. It was found that no positive value of Z^2 would improve the fit to the data over the fit obtained by a straight second neighbor Born–von Karman model. Although the charge bond correction does not by itself explain the long-range contribution to the to the dispersion curves, it will have to be considered in any full treatment of the lattice dynamics of diamond. Author

N67-28083# General Electric Co., Oklahoma City, Okla. Computer Operation.
SEMICONDUCTOR OPTICAL SHUTTER Final Report, Nov. 1965–Sep. 1966
R. H. Vought and R. L. Thompson Dec. 1966 56 p refs
(Contract AF 41(609)-2899)
(S-67-1031; AD-648089) CFSTI: HC$3.00/MF$0.65

The objective of the Semiconductor Optical Shutter program was to investigate the feasibility of using a normally transparent semiconductor as a viewing panel which can, by proper stimulation, be rendered opaque rapidly, and which can be returned promptly to its normal, transparent state. The proposed approach was to produce a very high concentration of free charge carriers so that the normally transparent, insulating semiconductor becomes almost metallic and exhibits metal-like optical reflection and absorption characteristics. Carrier injection at a p-n junction, or carrier excitation by irradiation with electrons or with band-gap radiation (h nu > or = Eg) would be potential means for producing the needed high density of free carriers, but only the latter method was explored. Materials were evaluated by determining the transmission of visible radiation before and during exposure to high intensity bursts of ultraviolet light from a xenon flashtube. Rutile (TiO2) showed no effect at incident ultraviolet photon densities of approximately 10 to the 18th power photons/sq cm in approximately 400 microsec bursts. A sample of SrTiO3 showed about a 12% decrease of transmission under similar irradiation, and a CdS sample showed a decrease of 30% with slightly higher excitation. These results are interpreted in terms of the physical processes occurring. It appears that further work with these and related materials with special attention to surface preparation would result in materials offering good prospects for a successful semiconductor optical shutter. TAB

N67-28087# Cornell Univ., Ithaca, N. Y. Materials Science Center.
THREE-PHOTON PHOTOELECTRIC EFFECT IN GOLD
E. M. Logothetis and Paul L. Hartman 22 Feb. 1967 13 p refs
(Contract Nonr-401(47))
(Rept.-648; AD-648167) CFSTI: HC$3.00/MF$0.65

A report is given of the observation and study of a three-photon photoelectric effect in gold at room temperature using a Q-switched ruby laser (photon energy 1.786 eV). Gold has a (photoelectric) work function W = 4.8 eV, much higher than the energy of two laser photons (3.57 eV), but lower than the energy of three laser photons (5.36 eV). TAB

N67-28187# Harry Diamond Labs., Inc., Washington, D. C.
OPTICAL ABSORPTION SPECTRUM AND OPTICAL ZEEMAN EFFECT IN TRIPLY IONIZED YTTERBIUM-DOPED CALCIUM TUNGSTATE
George Jones Dec. 1966 25 p refs
(HDL-TR-1336; AD-649325) CFSTI: HC$3.00/MF$0.65

The absorption spectrum of 0.01- to 0.05-percent ytterbium-doped calcium tungstate at liquid helium temperature was measured. Some of the samples contained sodium for charge-compensation. The effect of Na-charge-compensation for Yb was similar to that for Na-compensated Ce in the same host. The spectrum contains an extensive complex structure that is not explained by present theory. Two vibronic lines associated with the lattice modes previously reported are identified. The crystal field parameters were calculated to fit the main lines of the spectrum. These were calculated with and without mixture of states of unequal J. Measurements of the Zeeman effect allow the unambiguous identification of the lowest 2F5/2 symmetry. In terms of the free-ion J M states, this level consists of a combination of M = plus or minus 5/2 and plus or minus 3/2 function. The g values observed at 31 koe for this state are g (parallel) = 1.2 plus or minus 0.1 and g (perpendicular) = 1.5 plus or minus 0.1. Author (TAB)

N67-28226*# International Information, Inc., Philadelphia, Pa.
SOME PECULIARITIES OF THE VOLT–AMPERE CHARACTERISTICS OF THIN CADMIUM SULFIDE SINGLE CRYSTALS WITH NONOHMIC CONTACTS [NEKOTORYYE OSOBENNOSTI VOL'TAMPERNYKH KHARAKTERISTIK TONKIKH MONOKRISTALLOV SUL'FIDA KADMIYA S NEOMICHESKIMI KONTAKTAMI]
A. S. Gershun, L. A. Sysoyev, and B. L. Timan Washington, NASA, Dec. 1966 4 p refs Transl. into ENGLISH from Fiz. Tverd. Tela (Moscow), v. 8, no. 5, 1966
(Contract NASw-1499)
(NASA-TT-F-10469) CFSTI: HC $3.00/MF $0.65 CSCL 20L

A brief discussion of the current-voltage characteristics of In electrodes is presented. The electrodes were applied by sputtering on X and Z cuts of 100 to 200μ CdS single crystals at room temperature or at 300°C. A well pronounced hysteresis was observed in Z-cut samples, with In contacts applied at room temperature. Author

N67-28233*# Holman (John F.) and Co., Inc., Washington, D. C.
PHOTOCONDUCTIVITY AND ITS INFRARED QUENCHING IN MERCURY SULFIDE CRYSTALS WITH Cu AND Ag IMPURITIES [FOTOPROVIDNIST' TA II INFRACHERVONE GASINNYA V KRISTALAKH SIRCHASTOY RTUTI Z DOMISHKAMI Cu TA Ag]
V. E. Lashkarev and V. V. Rybalka Washington, NASA, May 1967 14 p refs Transl. into ENGLISH from Ukr. Fiz. Zh. (Kiev), v. 11, Apr. 1966 p 372–381
(Contract NASw-1495)
(NASA-TT-F-10920) CSCL 20B

The regularity of the intrinsic photoconductivity and infrared quenching in HgS (Cu and Ag) samples was investigated. The results are explained in the framework of a semi-conductor model with two recombination channels in the forbidden zone. Some of the parameters of the slow recombination centers produced by Cu and Ag admixtures in HgS are defined. Author

N67-28236*# Farnham (Frank C.) Co., Philadelphia, Pa.
THE FORMATION OF VACANCIES IN THE CASE OF DIFFUSION OF METAL ATOMS THROUGH A SURFACE OXIDE FILM AND THE EFFECT OF THE MEDIUM OF DISLOCATION STRUCTURE [OBRAZOVANIYE VAKANSKIY PRI DIFFUZII ATOMOV METALLA CHEREZ POVERKHNOSTNUYU OKISNUYU PLENKU I VLIYANIYE SREDY NA DISLOKATSIONNUYU STRUKTURU]
V. N. Rozhanskiy, A. A. Predvoditelev, and V. L. Indenbom Washington, NASA, Jun. 1967 11 p refs Transl. into ENGLISH from Fiz. Tverd. Tela (Moscow), v. 9, no. 3, 1967 p 757–765
(Contract NASw-1497)
(NASA-TT-F-11009) CSCL 20B

A hard film composed of an oxide, a hydroxide, or reaction products on a metal surface is "transparent" to interstitial atoms, but "nontransparent" to vacancies. Atom diffusion through this film leads to saturation of the metal bulk with vacancies, and to formation and growth of dislocation vacancy loops. Exposure of a metal in media which affect diffusion of metal atoms through an oxide film is shown to alter its dislocation structure. Author

N67-28306# Lyon Univ. (France). Institut de Physique Nucleaire.
STUDIES OF PROTON PENETRATION THROUGH SILICON MONOCRYSTAL [ETUDE DES EFFETS DIRECTIONNELS CRISTAL DE SILICUM]
Joseph Remillieux (Ph.D. Thesis) Nov. 1966 122 p refs In FRENCH
(LYCEN-6654)

The channeling effects undergone by protons in a silicon monocrystal were studied. A mechanical device having the angular precision necessary to locate the incident beam in the crystalline lattice and to put in operation a high-resolution detection chain making possible the fine study of the channeled beams was developed. A detailed analysis then was made of the channeling existing in the principal directions of axes and planes of a crystal of 20 μ thickness. The analysis was made under the double aspect of the intensity and the energy distribution of the transmitted beams. The results obtained are in good agreement with the classical theory of channeling. The importance of the different multiple scattering processes was confirmed by a photographic method. Experimental results were also given with respect to particles undergoing abnormally high energy losses in certain directions. A classical theory of channeling and different experiments which have shown the effect of crystalline lattices on the movement of a charged particle are reported. N5A

N67-28329# Linde Div., Union Carbide Corp., Indianapolis, Ind.
CZOCHRALSKI RUBY Annual Technical Summary Report, Jan. 1–Dec. 31, 1966
George A. Keig, O. H. Nestor, Peter E. Otten, and J. C. Smith 20 Mar. 1967 53 p refs
(Contract Nonr-4132(00); ARPA Order 306-62)
(SRCR-67-5; AD-649282) CFSTI: HC $3.00/MF $0.65

The Czochralski growth technique was developed to yield large ruby crystals with optical quality suitable for use as solid state lasers. This involved a scale-up of the present growth process to produce crystals 2 inches in diameter and 12 inches long. The material properties of the ruby have been studied with special attention given to its behavior during active lasing. The properties receiving attention have been chromium distribution and the identification and removal of inclusions causing laser damage during Q-switched operation. Author (TAB)

N67-28337# Brown Univ., Providence, R. I.
PHYSICAL RESEARCH ON FUNDAMENTAL PROPERTIES OF II–VI COMPOUND SEMICONDUCTORS Final Report
Charles Elbaum, Arthur Lord, and Rohn Truell Nov. 1966 75 p refs
(Contract AF 33(615)-2946)
(ARL-66-0225; AD-649242) CFSTI: HC $3.00/MF $0.65

It is well known that cadmium sulfide can act as a very nonlinear acoustic conductor under the appropriate conditions of acoustic frequency, specimen conductivity and applied dc electric field. Direct distortion of the acoustic waveform was observed, at 20 Mc/sec, as a function of conductivity and applied electric field. The maximum distortion appears to occur at the value of electric field where the acoustic velocity (shear waves were used) equals the charge carrier drift velocity. Ultrasonic attenuation measurements have been made at 12, 30 and 46 Mc/sec and from room temperature to 1.8K on a cadmium sulfide specimen. The specimen had a dark room temperature conductivity of about 10 to the minus 2nd power/(ohm-cm). A very large attenuation peak was observed in the neighborhood of 15 - 20K. Conductivity measurements, made concurrently with the attenuation measurements, showed that the peak was almost surely caused by the relaxation associated with space charge bunching. The attenuation data did not seem to show the proper frequency dependence above the peak temperature, but this issue is clouded because there was considerable uncertainty in the non-electronic background damping to be subtracted from the observed attenuation. Thin film, vacuum evaporated, acoustic transducers of cadmium sulfide and zinc sulfide were prepared and used on a variety of substrate materials. TAB

N67-28452# United Kingdom Atomic Energy Authority, Harwell (England). Atomic Energy Research Establishment.
RELATION BETWEEN THE MODIFICATIONS OBSERVED IN ZIRCONIA DURING ELECTROTRANSPORT TESTS AND DURING THE OXIDATION OF ZIRCONIUM

Gerard Beranger and Paul Lacombe Feb. 1966 9 p refs Transl. into ENGLISH from Compt. Rend. Acad. Sci. (Paris), v. 260, no. 20, 1965 p 5278–5281
(NP-TR-1407)

An attempt is made to interpret the changings in the color of zirconia layer formed during the oxidation of Zr by comparing them to observations made on zirconia exposed to the action of a continuous electric current at high temperature. This treatment leads to the creation of new anionic gaps. Author (NSA)

N67-28560# Stanford Research Inst., Menlo Park, Calif.
GROWTH AND CHARACTERIZATION OF β-SILICON CARBIDE SINGLE CRYSTALS Final Report, May 16, 1964–Jan. 15, 1967
W. E. Nelson, A. Rosengreen, R. E. Bartlett, F. A. Halden, and L. E. Marsh Feb. 1967 81 p refs
(Contract AF 19(628)-4190)
(AFCRL-67-0218; AD-651151) CFSTI: HC $3.00/MF $0.65

The process for growing Beta-silicon carbide single crystals from solution in carbon-saturated silicon melts was examined to determine how larger crystals may be obtained. Observed crystal growth effects resulting from increasing the carbon solute transport rate by stirring the solution are described and correlated with boundary layer theory. Both forward growth of platelets into the solution and lateral growth of platelets were accelerated by stirring. However, crystal growth in the forward direction was eventually limited by a boundary layer region, beyond which the solution was no longer supersaturated. Because of the decrease in boundary layer thickness with increasing stirring speed, the terminal lengths of silicon carbide platelets decrease with increasing stirring speed. Agreement between calculated crystal platelet lengths and experimental platelet lengths is good except at very low stirring speeds where free convection fluid motion is greater than the fluid motion caused by stirring. Large single-crystal Beta-silicon carbide platelets were grown in experiments in which convective stirring was reduced by crucible geometry and shielding. Addition of trace amounts of tantalum to the silicon melt improved the surface quality of crystals grown under conditions that normally favor the growth of coarse platelets. TAB

N67-28568# Harvard Univ., Cambridge, Mass. Gordon McKay Lab.
MAGNETIC SUSCEPTIBILITIES OF SOME RARE EARTH OXIDES Interim Scientific Report
Lewis Meredith Holmes Dec. 1966 250 p refs
(Contract AF 19(628)-3874)
(AFCRL-67-0038; AD-649050) CFSTI: HC $3.00/MF $0.65

The magnetic susceptibilities of the compounds R1/2Na1/2MoO4, with R = Gd, Tb, Dy, Ho, Er, Tm, and Yb, were measured between 2K and 300K for spherical, single crystalline samples. The compounds are paramagnetic and show large, axial anisotropy at low temperatures. The magnetic susceptibilities of samarium and europium gallium garnets (R3Ga5O12, with R = Sm and Eu) were measured between 2K and 300K. The magnetic susceptibility of polycrystalline Eu3O4, which is isomorphous with orthorhombic calcium ferrite has a peak at 5K which is ascribed to antiferromagnetic ordering. However, the magnetic susceptibility above 20K indicates predominantly ferromagnetic interactions. A simple model, consistent with this result involves ferromagnetic chains of spins, polarized along the c axis, with neighboring chains antiferromagnetically arranged. Measurements on single crystalline fragments show that the compound undergoes a metamagnetic transition at a critical field Hc along the c axis. Author (TAB)

N67-28689# Boeing Co., Seattle, Wash. Solid State Physics Lab.
THE PROBABILITY DISTRIBUTION OF THE DISTANCES BETWEEN ATOMS IN A LATTICE
Peter Gruner Jan. 1967 36 p refs
(D1-82-0593; AD-651146) CFSTI: HC $3.00/MF $0.65

The thermal vibrations in a lattice cause fluctuations of the interatomic distances. The probability distribution of those distance changes is derived by using the distribution function of the displacements from the equilibrium positions of the atoms. Numerical results are given for copper in the low temperature range where the crystal can be approximated by an elastic continuum. Author (TAB)

N67-28803# Aktiebolaget Atomenergi, Stockholm (Sweden).
SCATTERING OF NEUTRONS BY AN ANHARMONIC CRYSTAL
T. Hoegberg, L. Bohlin, and I. Ebbsjoe Apr. 1967 38 p refs
(AE-274) CFSTI: HC $3.00/MF $0.65

Numerical calculations have been performed for the anharmonic effects in neutron scattering. The phonon frequency widths and shifts have been calculated as a function of neutron frequency at different wave numbers and temperatures for a potential with central symmetry and for a face-centered cubic lattice. Author (ESRO)

N67-28843 Gt. Brit. Ministry of Aviation, Mottingham. Technical Information and Library Services.
DETECTION OF DISLOCATIONS DURING THE DEGRADATION OF TUNGSTEN, TANTALUM AND NICKEL MONOCRYSTALS [UEBER DEN NACHWEIS VON VERSETZUNGEN BEIM ABBAU VON WOLFRAM-, TANTAL-, UND NICKEL-EINKRISTALLEN]
Drechsler, G. Pankow, and R. Vanselow 1966 14 p refs Transl. into ENGLISH from Physik. Chem. (Frankfurt), v. 4, 1955 p 249–263
(TIL/T-5666)

Several methods are described for causing the gradual degradation of the monocrystal tip of a field emission microscope under the combined action of temperature and the electrical field. In the case of W, Ta and Ni, eccentric degradation centers, also spiral degradation stages observed in the emission picture, are interpreted as signs of screw dislocations. Degradation centers develop only on equilibrium faces, e.g. in the case of W, on 011, 001 and 112; i.e. the axes of the screw dislocations are orientated perpendicularly to them. On account of its high resolving power, the field ion microscope is more suitable for the investigation of degradation than the field electron microscope. The stage heights calculated from the stage distances are from 5Å upwards. Author

N67-28852 Nuklearni Institut Josef Stefan, Ljubljana (Yugoslavia).
REORIENTATION FREQUENCIES OF FERROELECTRIC DIPOLES NEAR A PARAMAGNETIC CENTER IN NEUTRON IRRADIATED KH_2AsO_4
R. Blinc, P. Cevc, and M. Schara Jan. 1967 6 p refs Submitted for publication
(NIJS-R-495)

The frequency of exchange between the various "Slater" type H_2AsO_4 dipolar configurations near a local paramagnetic center has been measured in the paraelectric phase of neutron irradiated KH_2AsO_4, using an EPR technique. The results show the absence of an instability of the lattice against any ferroelectric mode, involving proton displacements, and favor the order–disorder model of ferroelectricity in this class of crystals. This paper reports what we believe is the first direct measurement of the frequency of exchange between the "Slater" dipolar configurations in any KH_2PO_4 type ferroelectric. The purpose of the work was: (1) to elucidate the dynamics of the ferroelectric dipoles in KH_2AsO_4, and (2) to find out whether the phase transition in hydrogen bonded KH_2PO_4 type crystals can be understood in terms of an instability of the lattice against a ferroelectric mode as in displacive ferroelectrics, or if a modified Slater order–disorder model still applies. Author

N67-28853# Colorado Univ., Boulder.
TRANSVERSE MAGNETORESISTANCE IN N-TYPE GERMANIUM Technical Report, 1 Jun. 1965–31 Nov. 1966
William F. Love and Jean F. Gallagher Mar. 1967 28 p refs
(Contract Nonr-1147(12))
(TR-1; AD-648446) CFSTI: HC $3.00/MF $0.65

The transverse magnetoresistance and Hall coefficient in high-resistivity n-type germanium were measured in pulsed magnetic fields up to 175 kgauss at temperatures between 20K and 70K. The magnetoresistance ratio was roughly proportional to HT to the minus 1.2 power for fields above 100 kgauss and temperatures below 40K for two orientations; H in the <111> direction. It was proportional to H to the 1.2 power T to the minus 1.5 power for H in the <001> direction. This behavior is not attributed to gradients in carrier concentration or to surface effects. The Hall coefficient increased with H at temperatures below 20K for H in the <001> direction. This is attributed to a decrease in the conduction-band electron density due to a change in the ionization energy. Calculations by D. F. Minner predict such a decrease for H in the <001> direction but no decrease for H in the <111> direction. Author

N67-28881# Northrop Corp., Newbury Park, Calif. Applied Research Dept.
GENERALIZED MODEL FOR SEMICONDUCTOR RADIATION RESPONSE PREDICTION Quarterly Report, 15 Sep.–14 Dec. 1966
James P. Raymond and Robert E. Johnson Mar. 1967 79 p refs
(Contract DA-28-043-AMC-00423(E))
(ECOM-00423-7; QR-7; Rept.-7; AD-650103) CFSTI: HC $3.00/MF $0.65

Electrical and ionizing radiation experiments were performed on junction isolated monolithic integrated transistor and resistor elements and comparisons are presented between their measured and calculated junction areas and electrical and ionizing radiation response. The electrical lumped-model representation of a junction field effect ransistor was developed. The bipolar transistor model was increased in detail so that the following parameters are now variable: collector depletion layer width, collector lifetime, and emitter and collector junction capacitance. A sophisticated numerical integration routine for solving lumped model equations is presented. A test fixture designed to minimize parasitic radiation response is described. Author (TAB)

N67-28902# Union Carbide Corp., Tonawanda, N. Y. Electronics Div.
SINGLE CRYSTAL PEROVSKITES AS ELECTROOPTICALLY ACTIVE MATERIALS Quarterly Progress Report 1 Jul.–1 Oct. 1966
H. Fay 1 Oct. 1966 26 p refs
(Contract AF 33(615)-5410)
(QPR-1; AD-650410) CFSTI: HC $3.00/MF $0.65

A two year research and development program on electrooptically active perovskite crystals was initiated. The program consists of three parts; growth improvement of potassium tantalate niobate (KTN) crystals, development of new complex perovskite compounds and electrooptical evaluation of these crystals. An improvement in the reproducibility and quality of KTN crystals was realized. A literature search for complex perovskite compounds and a computer program to generate the formulas and unit cell sizes for all possible complex perovskites are underway. Special methods for measuring the required electric, and electrooptic properties of crystals was developed and can now be used for studying the behavior of KTN crystals. Author (TAB)

N67-28952# Radio Corp. of America, Princeton, N. J.
THEORETICAL AND EXPERIMENTAL STUDY OF THE ANOMALOUS HALL EFFECT Scientific Report No. 2
Peter D. Southgate, Hans J. Prager, Shing-gong Liu, and Kern K. N. Chang 30 Sep. 1966 49 p refs
(Contract AF 19(628)-4386)
(AFCRL-66-729; AD-650330) CFSTI: HC $3.00/MF $0.65

Measurements and calculations were made of the interaction between infrared radiation and free electrons in semiconductors with applied magnetic and electric fields. Effects caused by Lorentz field interaction with static magnetic fields have been demonstrated, but the analogous effect in electric fields was obscured by heating. Calculations of the radiation resistance of the antenna array formed by the magnetic field are reported. Calculations were also performed on propagation of light down a waveguide containing drifting carriers, but these have not been completed due to boundary condition difficulties. The use of approximations valid at low frequencies reveals the presence of a slow eddy-current mode, which will delay a signal in a dispersionless manner for a variable time. Infrared emission of recombination radiation from high-conductivity GaAs was investigated. The effects are ascribed to ionization in the high-field region of inhomogeneously formed Gunn domains. Measurements of absorption of 3.4-micrometers light by field-generated holes agree with the estimates of hole density derived from the current-voltage curves. Infrared power densities of 300 W/sq cm were observed, which approach those required for laser action. Author (TAB)

N67-28969# California Univ., La Jolla. Dept. of Physics.
ANISOTROPY EFFECTS IN THE EXCITONIC INSULATOR
Johannes Zittartz 17 Mar. 1967 27 p refs
(Contract Nonr-2216(11))
(TR-45; AD-649649) CFSTI: HC $3.00/MF $0.65

A new insulating phase in semiconductors and semimetals has been discussed recently in the literature. The analysis of this excitonic phase is extended to the more general case of an anisotropic band structure of the underlying two band model. The thermodynamic properties of the excitonic phase are worked out. Whereas the anisotropy does not lead to qualitstively new features in the case of a positive band gap (semiconductor region), important changes occur in the case of a negative band gap (semimetallic region). The latter situation is discussed in detail. Finally the phase diagram of the excitonic phase is calculated for a particular anisotropic band model. Author (TAB)

N67-28973# Washington Univ., Seattle.
MAGNETIC RELAXATION IN CRYSTALS Final Report
Edwin A. Uehling Apr. 1967 14 p refs
(Grant DA-ARO(D)-31-124-G436)
(AROD-3955-2-P; AD-651133) CFSTI: HC $3.00/MF $0.65

A primary objective of the studies was a better understanding of the hydrogen bond dynamics on which the spin relaxation so largely depended. The topics included are: (1) Intrabond motion in KH_2PO_4 type crystals. (2) Proton and deuteron spin relaxation in anti-ferroelectric $NH_4H_2PO_4$. (3) Arsenic-proton cross-over relaxation in KH_2AsO_4. (4) Acoustic wave propagation at the Curie temperature in KH_2PO_4 type crystals. (5) Spin-diffusion relaxation. (6) Ferromagnetic resonance in bulk samples of supermalloy and nickel for various orientations of the magnetic field with respect to the surface of the sample. (7) Magneto - acoustic effects in Aluminum at high radio frequencies and at 4.2 K. TAB

27 PROPELLANTS

Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

N67-28795# Bureau of Mines, Bartlesville, Okla. Petroleum Research Center.
HYDROGENATION STUDIES OF DISTILLATE FUELS
Charles Simar Allbright, Frank G. Schwartz, and Cecil C. Ward Jun. 1967 25 p
(BM-RI-6981) CFSTI: HC $3.00/MF $0.65

Hydrogenation of petroleum distillate fuels in bench scale equipment and the effects of hydrogenation on the storage stability and the composition of the fuels are described. Two distillate fuels were hydrogenated in laboratory equipment using a commercially available cobalt molybdate catalyst. Reactor temperatures were varied from 600° to 850°F and pressures from 100 to 600 psig. Product fuels were analyzed by ASTM, mass, and infrared methods. Hydrogenation of a catalytically cracked fuel from Oklahoma crude oil significantly improved the storage stability, reducing insoluble gum formed during 9 months of storage at 110°F from 19.0 to 1.3 mg per 100 ml fuel, average. Conversion of the olefins to other hydrocarbon types varied with the temperature of hydrogenation—at 700° to 850°F the conversion was mainly to aromatics, at 650°F about 50:50 to saturates and aromatics, at 600°F principally to saturates. Processing a fuel composed of a mixture of virgin distillate and catalytically cracked stock, both from Illinois crude, at 700°F and 200 psig effected marked improvement in stability; the buildup of insoluble gum in storage was lowered from 18.3 to less than 1 mg per 100 ml fuel. Author

28 PROPULSION SYSTEMS

Includes air breathing, electric, liquid, solid, and magnetohydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

N67-27880 Brussels Univ. (Belgium).
STUDY OF ENERGY OF REACTION PROPULSION OF AIR CUSHION VEHICLES [ETUDE ENERGETIQUE DE LA PROPULSION PAR REACTION DES VEHICULES A COUSSIN D'AIR]
A. Jaumotte, A. Kiedrzynski, and J. Servais 1966 42 p refs In FRENCH
(NT-6-1966; Rept.-1; DRME-79-65)

The energy balance of the air jet propulsion system of an air cushion vehicle was studied. Calculation was made on separate and common ventilators, and a numerical example is presented on a vehicle constructed around a 240 ch motor with both types of ventilation. A comparison of performance is made between vehicles propelled by air jets, and propeller-driven vehicles. Transl. by R.U.

N67-27921# Vereinigte Flugtechnische Werke G.m.b.H., Bremen (West Germany).
ON THE OPTIMIZATION OF THE POWER PLANT FOR A SHORT RANGE AIRCRAFT WITH SPECIAL REGARD TO HIGH BY-PASS RATIOS [ZUR OPTIMIERUNG DER TRIEBWERKSANLAGE EINES KURZSTRECKENFLUGZEUGES UNTER BESONDERER BERUECKSICHTIGUNG HOHER BY-PASS VERHAELTNISSE]
Horst Pakendorf [1966] 41 p refs In GERMAN; ENGLISH summary Presented at the Ann. Joint Meeting DGRR/WGLR Bad Godesberg, W. Germany, Oct. 1966
(DGRR/WGLR Paper-66-085) CFSTI: HC $3.00/MF $0.65

The development of turbofan engines with high by-pass ratios offers new potentialities in design and application of jet propulsion. In the following, the optimization of the power plant for a short range aircraft is conducted with special regard to the correlation between aircraft design and engine, and to the resulting take-off and cruising thrust requirements, engine and take-off weights, and operating costs. It will be demonstrated that at the present level of engine development short range aircraft should be equipped with by-pass engines of medium by-pass ratios (3 to 5), as these result in minimum take-off weight and operating costs of the aircraft. The optimum by-pass ratio in regard to operating costs being of special importance for civil application, lies at about 3. Higher turbine temperatures to be expected in future, enable optimum engine design, resulting without exception in lower take-off weight and operating costs at higher by-pass ratios. Minimum operating costs are achieved at a by-pass ratio of 4.5. Author (ESRO)

N67-27960# Army Tank-Automotive Center, Warren, Mich.
THE THEORY OF OPERATION OF AN AMMONIA BURNING INTERNAL COMBUSTION ENGINE
Charles G. Garabedian and John H. Johnson *In* Army Dept. Proc. of the 1966 Army Sci. Conf., Vol. I 26 Aug. 1966 p 333–346 refs (See N67-27941 15-34)
(AD-634681)

Conversion of the present military fleet of engines to ammonia operation is considered to be both costly and impractical. Extensive modifications are necessary for spark-ignition and compression-ignition engines to operate on ammonia only; and the compression-ignition engine must first be converted to a spark-ignition engine in order to operate with ammonia as an automotive fuel. Increased fuel requirements for ammonia operation with current vehicles would require a tremendous increase in vehicle size at the expense of vehicle performance. To effect savings in cost, weight, volume, and complexity, ammonia operation must be integrated into original designs of future engines; and it is speculated that practical engines with ammonia-hydrocarbon multi-fuel capability will be feasible in the 1975–1980 period. M.W.R.

N67-28018* Hughes Aircraft Co., Culver City, Calif.
AN EVALUATION OF COMPOSITE TEFLON–ALUMINUM FOIL BLADDERS FOR THE SURVEYOR VERNIER PROPULSION SYSTEM
2 Mar. 1967 72 p refs Prepared for JPL
(Contracts NAS7-100; JPL-950056)
(NASA-CR-84663; SSD-78020) CFSTI: HC $3.00/MF $0.65 CSCL 21H

The Surveyor vernier propulsion system operates on MON-10 and MMH-hydrate propellants. During the mission, the present Teflon bladders which contain the propellants allow the helium pressurant gas to permeate at a rate such that the propellants are saturated prior to spacecraft terminal descent. The results of a comprehensive engineering evaluation of composite Teflon–aluminum foil bladders for the Surveyor vernier propulsion system are presented. The primary purpose of the program was to determine the effectiveness of the aluminum foil as a helium permeation barrier. The test program covered helium and nitrogen permeation, vibration and propellant exposure effects, expulsion life, propellant permeation, physical properties tests, and development of improved bladder installation techniques. Estimates of the effect of propellant saturation fraction on spacecraft stability parameters are presented. Author

N67-28081# Institute of Modern Languages, Inc., Washington, D. C. Translation and Interpretation Div.
ABOUT THE INFLUENCE OF THE NUMBER OF OPERATING BLADES OF AXIALLY RADIAL COMPRESSOR UPON ITS CHARACTERISTICS [OVLIYANII CHISLA ZABOCHIKH LOPATOK OSEZADIALNOGO KOMPRESSORA NA EGO KHARACTERISTIKI]

A. N. Sherstyuk, Ye. N. Zaychenko, E. V. Abottin, and V. A. Kriger Mar. 1967 17 p refs Transl. into ENGLISH from Aviatzionnaya Technica (Kazan), no. 4, 1965 p 125–132
(Contract DA-44-009-AMC-1563(T))
(ERDL-T-1897-67; TT-67-61283; AD-648402) CFSTI: HC $3.00/MF $0.65

The influence of the number of operating blades upon the characteristics of compressors of stationary type with backward bent blades is discussed in detail. TAB

N67-28262# Avco Corp., Stratford, Conn. Lycoming Div.
POWER PLANT STUDY FOR SHAFT-DRIVEN HEAVY-LIFT ROTARY-WING AIRCRAFT Final Report, Jul.–Dec. 1964
Heinz Moellmann, and William O'Connor Jan. 1967 192 p refs
(Contract DA-44-177-AMC-242(T))
(Rept.-1882.1; USAAVLABS-TR-66-42; AD-649534) CFSTI: HC $3.00/MF $0.65

Studies were conducted on various multiengine gas turbine propulsion systems for a shaft-driven, heavy-lift helicopter. The helicopter was based on a design gross weight of 75,000 to 85,000 pounds, having a 40,000-pound payload. Growth versions of existing gas turbine engines were applied to the study. The following types of engine systems were investigated: free-power turbine, mechanical coupling, regenerative, front drive, fixed-power turbine, gas coupling, nonregenerative, and rear drive. The engine packaging arrangements were vertical and horizontal installations in single-, tandem-, and quad-rotor helicopters. The prime study criteria were weight savings (fuel plus installed engine) and helicopter performance. Additional subjects of study were: power augmentation by water-methanol injection or increased turbine-inlet temperature; electrical, hydraulic, and pneumatic starting systems; and control problems concerning load sharing, engine-out operation, and stability. Author (TAB)

N67-28292*# National Aeronautics and Space Administration, Washington, D. C.
GAS TURBINE EFFICIENCY AS AFFECTED BY DISCHARGE OF COOLANT AIR FROM THE STATIONARY BLADES INTO THE BLADING [K VOPROSU O VLIYANII NA EFFEKTIVNOST' GAZOVOY TURBINY VYPUSKA Y YEYE PROTOCHUNYU CHAST' OKLAAZHDAYUSHCHEGO VOZDUKHA IZ LOPATOK]
Ye. N. Bognomolov Mar. 1967 12 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Aviats. Tekh. (Kazan), v. 9, no. 2, 1966 p 49–58
(NASA-TT-F-10779) CSCL 21E

Theoretical analysis of the problem of cooling a gas turbine with the air from its own blades. The mixing of gas behind the blade array with air from the blade edge and the effect of the injected air on the efficiency of the turbine state are examined. Author

N67-28636# Naval Air Engineering Center, Philadelphia, Pa. Materials Application and Engineering Div.
DEVELOPMENT OF DESIGN FACTORS FOR AN OIL FREE LUBRICATED INTERNAL COMBUSTION GASOLINE ENGINE
J. P. Cerini 28 Sep. 1966 14 p refs
(NAEC-AML-2460; AD-650098) CFSTI: HC $3.00/MF $0.65

Test results of an oil free, solid film lubricated internal combustion gasoline engine employing molybdenum metal and reservoirs for lubricant in selected wear zones show a performance life of 6 hours at speeds of 2500 - 3000 rpm. A similar test engine run at low temperatures shows a rapid starting capability at -65F. Author (TAB)

N67-28642*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ELECTRIC PROPULSION
In its Res. and Advanced Develop., Vol. II 31 Jan. 1967 p 3–23 refs (See N67-28641 15-34)

Flight-ready technology of solar-powered electric propulsion components and subsystems for mission applications is being investigated, and results of feasibility studies on electric propulsion are reported. Mission performance analysis, solar power development, and trajectory programming are considered. Computer program development is discussed for a low-thrust trajectory analysis. M.W.R.

N67-28656*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
LIQUID PROPULSION TECHNOLOGY
In its Res. and Advanced Develop., Vol. II 31 Jan. 1967 p 333–367 refs (See N67-28641 15-34)

Various studies are reported that deal with the advancement of liquid propulsion technology. Development is underway for improving monopropellants consisting of mixtures of hydrazine and compounds such as chlorates and nitrates, and resonant combustion is being studied to determine the applicability of a rotating detonation-like wave concept to an understanding of destructive oscillatory liquid rocket combustion modes. Other projects deal with atomization and injector hydraulics, gas side boundary phenomena, combustion effects in sprays, chemistry of OF_2 and B_2H_6 propellants, physical processes in supercritical environments, reduction of turbulent heat transfer in nozzles. M.W.R.

N67-28657*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SOLID PROPULSION TECHNOLOGY
In its Res. and Advanced Develop., Vol. II 31 Jan. 1967 p 369–403 refs (See N67-28641 15-34)

A wide variety of projects is being considered in connection with solid propulsion technology, including rocket materials and components development, rheological properties of propellants, and thermal degradation of polyurethanes and hydrocarbon polymers. Propellant stress analyses are concerned with improving state of the art stress transducers, development of stress-freezing techniques to study three-dimensional stress fields in solid propellants, a propellant family based on beryllium and LMH_2, advanced binders, high energy oxidizer propellants, and solid rocket gas dynamics studies. M.W.R.

N67-28658*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
LIQUID SPACE PROPULSION SYSTEMS
In its Res. and Advanced Develop., Vol. II 31 Jan. 1967 p 408–428 refs (See N67-28641 15-34)

Technology of liquid propulsion systems is being advanced for unmanned spacecraft in order to plan for future missions. Advanced combustion device development is concerned with the use of N_2O_4–N_2H_4, N_2O_4–MMH, and OF_2–B_2H_6 propellants; and studies in this area deal with sheet formation, impinging-sheet spray parameter optimization, 2000-lb_f-thrust heavyweight and flight prototype impinging-sheet injectors, propellant valves, cup-and-plug injectors, test cell "G" buildup, and the brazing program for pyrolytic graphite thrust chambers. Pressure and flow controls, positive expulsion devices, elements for seal static and dynamic applications, and other liquid propulsion components are being studied. M.W.R.

N67-28659*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
LIQUID AUXILIARY PROPULSION SYSTEM
In its Res. and Advanced Develop., Vol. II 31 Jan. 1967 p 429–434 refs (See N67-28641 15-34)

A warm-gas actuator system development program is concerned with a hydrazine plenum system for an attitude control, mass explusion, torquing system. A breadboard 40-day test to determine the residues being carried into the cold-gas distribution system is reported. A reaction control gas supply system is studied for the advanced spacecraft designs of the Voyager class. M.W.R.

N67-28664# Deutsche Forschungsanstalt fur Luft- und Raumfahrt, Brunswick (West Germany). Institut fuer Strahlantriebe.
AIR SEPARATION IN AIR-BREATHING BOOSTERS FOR SPACE VEHICLES [LUFTTRENNUNG IN LUFTSAUGENDEN TRIEBWERKEN FUER RAUMFAHRZEUGTRAEGER]
Gisela Stoffers Dec. 1966 32 p refs In GERMAN; ENGLISH summary
(DLR-FB-66-90)

One of the suggestions that have been made concerning the development of air-breathing boosters for space vehicles includes a combination of a ramjet engine and an air separation device. Part of the air taken in is to be liquefied and separated with the liquid hydrogen fuel being used as coolant. The nitrogen is then added to ramjet gas flow. The liquid oxygen is stored for use in an upper rocket stage. A short presentation of the thermodynamics of air separation as far as it is needed for a systems analysis is given. Subsequently, several circuit schemes for such a system are developed. Author

N67-28677 Deutsche Forshungsanstalt fur Luft- und Raumfahrt, Brunswick (West Germany). Institut fuer Strahlantriebe.
INVESTIGATIONS ON AFTERBURNERS WITH AERODYNAMIC FLAMEHOLDING [UNTERSUCHUNGEN AN NACHBRENNERN MIT AERODYNAMISCHER FLAMMHALTUNG]
W. Alvermann and R. Ulken Dec. 1966 35 p refs In GERMAN; ENGLISH summary
(DLR-FB-66-88)

For a model-afterburner with secondary air jets as a means for flame holding which are injected in an oblique direction against the flow the efficiency of the combustion, the pressure loss, the fuel-air-ration, and the mean exhaust temperature are determined and discussed for different pressures of the secondary air. The results show a particularly low pressure loss compared with usual stabilizers. Further a survey is given about investigations at a test-afterburner for a Marboreturbojet engine with aerodynamic flame stabilization. Author

N67-28740*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DYNAMIC RESPONSE OF GASEOUS-HYDROGEN FLOW SYSTEM AND ITS APPLICATION TO HIGH-FREQUENCY COMBUSTION INSTABILITY
Charles E. Feiler and Marcus F. Heidmann Washington, NASA, Jun. 1967 12 p refs
(NASA-TN-D-4040) CFSTI: HC $3.00/MF $0.65 CSCL 21H

The dynamic response characteristics of a lumped-element model of a gaseous-hydrogen injector were determined. The investigation was conducted to determine whether coupling between hydrogen flow oscillations and chamber pressure oscillations could be large enough to provide a mechanism for driving high-frequency combustion instability. The model was derived in terms of the injector design variables and was evaluated for three engines of different scales. The results are presented to show the effect of hydrogen density (temperature) on the coupling, since this parameter is useful in determining stability limits experimentally. A comparison of predicted and experimental stability limits was made which showed general agreement between experiment and theory. Such flow system coupling has been known to be of importance in low-frequency instability for some time. The results show that, for gaseous flow systems, flow system coupling is an important factor in causing high-frequency instability also. Author

N67-28783*# General Electric Co., Cincinnati, Ohio. Space Power and Propulsion Section.
ANALYTICAL METHODS FOR RESISTANCE JET DESIGN Supplementary Report No. 1
Robert Viventi Cincinnati, Ohio, Aug. 1964 67 p refs
(Contract NAS5-9013)
(NASA-CR-84823; R64SD3008) CSCL 21H

Analytical methods are presented for designing a resistance jet thruster to be used for stationkeeping and attitude control functions of a space vehicle. The steps considered include the thermodynamic design, optimization of the expansion nozzle, length of flow passage, size and life of the heater filament, and radiation heat shielding. The transient performance of the thruster is then calculated, and appropriate modifications can be made if desired, to change the time constant and minimum impulse bit of the thruster. Effects on the vehicle are analyzed; and a procedure is given for designing the thruster so as to minimize the overall weight penalty on the vehicle. Author

N67-28895# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
TURBINE BLADE [LOPATKA TURBOMASHINY]
A. L. Lubny–Gertsyk and Ye. M. Shvartsshteyn 23 Jan. 1967 6 p Transl. into ENGLISH from Russian Patent No. 179129 (Appl. no. 884706/24-6, 27 Feb. 1964) 1 p
(FTD-HT-66-707; AD-649339) CFSTI: HC $3.00/MF $0.65

A turbine blade with external fluid-droplet cooling is described. To improve its reliability, the blade is coated with a high-thermal-conductivity material, such as copper. TAB

N67-28910# Boeing Co., Seattle, Wash. Turbine Div.
SMALL GAS TURBINE ENGINE COMPONENT TECHNOLOGY HIGH-TEMPERATURE TURBINE MATERIALS RESEARCH Final Report
John Acurio, Lou J. Fiedler, and Fred H. Simpson Dec. 1966 168 p refs
(Contract DA-44-117-AMC-173(T))
(DA-3298; USAAVLABS-TR-66-88; AD-651103) CFSTI: HC $3.00/MF $0.65

The report describes research conducted on two new material systems (macrolaminate metal-ceramic composites and dispersion-strengthened nickel base alloys) to determine their potential for future use, without special cooling, in the turbine section of an advanced small gas turbine engine, operating at a turbine inlet temperature of 2300F. Although the research showed that the targeted high-temperature material properties could not be achieved with the macrolaminate composites or the dispersion-strengthened alloys, it was felt that these types of materials could be developed to increase turbine inlet temperatures to about 2100F. However, it was recognized that this gain would not be sufficient in view of improvements being made with other new material systems. Author (TAB)

N67-28960# Aerospace Research Labs., Wright-Patterson AFB, Ohio.
A THEORETICAL ANALYSIS OF THE BLUNT-TRAILING-EDGE SUPERSONIC COMPRESSOR AND COMPARISON WITH EXPERIMENT
Arthur J. Wennerstrom and Stavros Olympios Nov. 1966 91 p refs
(ARL-66-0236; AD-650134) CFSTI: HC $3.00/MF $0.65

The report describes the mathematical flow model developed for predicting the quasi-three dimensional performance of a blunt-trailing-edge supersonic rotor. A comparison of the theory with experiment is made. Some general performance trends are described and means by which performance might be improved are considered. Finally, the blunt-trailing-edge design philosophy is discussed by considering the effects of the blade geometric parameters on the overall rotor performance. It was concluded that the flow model is adequate to predict mass-average performance. However, further refinements are necessary in order to predict the measured radial distributions downstream of the rotor. Author (TAB)

29 SPACE RADIATION

Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also: 13 Geophysics; and 24 Physics, Atomic, Molecular, and Nuclear.

N67-27924# Royal Inst. of Tech., Stockholm (Sweden).
THEORY OF ELECTRIC FIELD MEASUREMENTS CONDUCTED IN THE MAGNETOSPHERE WITH ELECTRIC PROBES
U. Fahleson Paris, ESRO, May 1966 48 p refs Presented at the ESRO Colloq. on Auroral and Assoc. Magnetospheric Phenomena at Very High Latitudes, Stockholm, 16–18 Nov. 1965
(ESRO-SN-28) CFSTI: HC $3.00/MF $0.65

The possibilities for electric field measurements in the magnetosphere are investigated. A number of necessary design criteria for two- and three-electrode probe systems are deduced. From these criteria the minimum possible dimensions of the probe systems are calculated. Limitations due to plasma inhomogeneities and a flux of high energy particles are also given. Numerical values indicate that probe measurements of electric fields with an accuracy of 10–20% are feasible without great efforts in a large part of the magnetosphere. Author (ESRO)

N67-27930# Groupe de Recherches Ionospheriques, Issy-les-Moulineaux, (France).
RECENT PROGRESS IN THE STUDY OF V.L.F. AND E.L.F. WAVES [PROGRES RECENTS DANS L'ETUDE DES ONDES T.B.F. ET E.B.F.]
R. Gendrin Paris, ESRO, Oct. 1966 147 p refs In FRENCH; ENGLISH summary Presented at the ESRO Colloq. on Auroral and Assoc. Magnetospheric Phenomena at Very High Latitudes, Stockholm, 16–18 Nov. 1965
(ESRO-SN-31) CFSTI: HC $3.00/MF $0.65

Recent investigations on natural phenomena in the V.L.F. and E.L.F. ranges are reviewed. Protonic whistlers, transverse propagation, ionic plasma waves are described and the importance of resonance effects is stressed. High-latitude whistlers and hydromagnetic wave propagation are also analysed, as well as some experiments made with artificial transmitters. Numerical results about the electronic density and the ionic composition deduced from such studies are given. Present theories on the interactions between waves and particles are reviewed, particularly as regards the life-times of trapped particles and also the generating mechanism of V.L.F. and E.L.F. emission. Author (ESRO)

N67-27937# Royal Inst. of Tech., Stockholm (Sweden).
COUPLING BETWEEN THE OUTER MAGNETOSPHERE AND THE HIGH-LATITUDE IONOSPHERE
L. P. Block Paris, ESRO, May 1966 28 p refs Presented at the ESRO Colloq. on Auroral and Assoc. Magnetospheric Phenomena at Very High Latitude, Stockholm, 16–18 Nov. 1965
(ESRO-SN-26) CFSTI: HC $3.00/MF $0.65

Some aspects of the closed and open magnetospheric models are briefly discussed. The assumption that the geomagnetic field lines are equipotentials is criticized both on observational and on theoretical grounds. Measurements of Hα Doppler profiles, of precipitating particles above the ionosphere, and of charged particle densities in the magnetosphere indicate the existence of electric fields parallel with the magnetic field. Two different models of electric fields are considered which violate the condition of frozen-in magnetic fields. In one of them there are occasional transient electric field impulses along the field lines which cause precipitation splashes. The other model invokes electrostatic fields which vanish occasionally owing to instabilities. This gives rise to precipitation splashes of about equal numbers of ions and electrons. The latter model seems to be favoured by known satellite data concerning the pitch angle distributions of electrons above the ionosphere. Author (ESRO)

N67-28007*# Volt Technical Corp., Washington, D. C.
ANNUAL VARIATIONS OF COSMIC RAYS AND INTENSITY VARIATIONS OF COSMIC RADIATION AS A FUNCTION OF EARTH'S HELIOLATITUDE [GODOVYYE VARIATSII KOSMICHESKIKH LUCHEY I IZMENENIYE INTENSIVNOSTI KOSMICHESKOY RADIATSII V FUNKTSII GELIOSHIROTY ZEMLI]
L. I. Dorman, A. A. Luzov, and V. P. Mamrukova 27 Mar. 1967 6 p refs Transl. into ENGLISH from Dokl. Akad Nauk SSSR, Ser. Geofiz. (Moscow), v. 172, no. 4, 1967 p 833–836
(Contract NAS5-12487)
(NASA-CR-84672; ST-CR-10582) CFSTI: HC $3.00/MF $0.65 CSCL 20H

Results of unambiguous investigation of annual variations of cosmic rays are presented from the material of the world network of cosmic ray stations and aerological sounding with concomitant reference to data relative to other geophysical events for the year 1960. Analysis of the curves obtained shows that there is in the hard component a wave with a 12-month period, which does not exist in the neutron component. This is evidence that a great contribution is made to the seasonal variation of the hard component the annual variation of atmosphere temperature. Author

N67-28020*# Minnesota Univ., Minneapolis. School of Physics and Astronomy.
AN UPPER LIMIT ON THE QUIET TIME SOLAR NEUTRON FLUX AT ENERGIES > 60 MeV
W. R. Webber and J. F. Ormes Jan. 1967 16 p refs
(Grant NsG-281)
(NASA-CR-84665; CR-93) CFSTI: HC $3.00/MF $0.65 CSCL 20H

During the course of a series of balloon flights with Cerenkov-scintillation counters designed to measure the energy spectrum of charged primary cosmic ray nuclei it has been possible to set limits on the quiet time solar emission of neutrons in the approximate energy range above 60 Mev. These limits (which are nearly an order of magnitude smaller than previously reported), were obtained by comparing the intensity of secondary protons at $\simeq 12$ g/cm^2 atmospheric depth near the equator as measured on two balloon flights—one with the detector telescope oriented vertically and the other with the detector telescope oriented at a zenith angle of $\simeq 50°$ and rotating in azimuth. This latter telescope alternately pointed at the sun and at an angle 90° to the sun. The absence of any excess secondary proton flux when the detector was pointing at the sun allows us to set a 2 σ limit of < 1.0 protons/m^2-ster-sec in the energy range 60–320 Mev as being produced in the atmosphere above the detector by solar neutrons. Author

N67-28965# Harvard Coll. Observatory, Cambridge, Mass. Solar Dept.
CLASSIFICATION OF SOLAR PROMINENCES FOR SUNSPOT CYCLE NO. 19–1964
Donald H. Menzel and F. Shirley Jones Dec. 1966 95 p ref
(Contract AF 19(628)-3322)
(SR-12; AFCRL-67-0035; AD-651132) CFSTI: HC $3.00/MF $0.65

The report contains a tabulation and analysis of the behavior classification of prominences observed during 1964 at the Sacramento Peak Observatory, Sunspot, New Mexico. Author (TAB)

N67-28970# Geo-Science, Inc., Alamogordo, N. Mex.
SOLAR RESEARCH AND DEVELOPMENT AT SACRAMENTO PEAK OBSERVATORY Final Report, 1 Jan. 1964–31 Dec. 1966
Mark W. Jones Jan. 1967 25 p refs
(Contract AF 19(628)-3853)
(AFCRL-67-0106; AD-650362) CFSTI: HC $3.00/MF $0.65

The staff of Geo-Science, Inc. has cooperated and assisted with the staff of the Sacramento Peak Observatory in the solar research programs at the observatory for three years. The fundamental research work included studies of events preceding solar flares such as filament and plage activity, solar surges, and H alpha activity with the goal of increasing the reliability of predicting solar flares. Studies were made of the spectra of rapidly changing solar features, on the amount of Stark broadening of hydrogen lines in solar flares, and of the deviation from the Boltzmann distribution of excited H atoms in solar flares. The electronics research group contributed to the highly specialized instrumentation development at the observatory. These contributions included the design and development of units to aid in the data reduction, control systems for the various spectrograph and coronagraph systems, automatic data collection systems, control systems for the flare patrol program and the development of a Vidax system for transmission of solar flare pictures to AFCRL headquarters, and other locations. The staff also participated in one solar eclipse expedition, and designed and tested the spectrograph control systems for two eclipses. Author (TAB)

30 SPACE SCIENCES

Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbit and trajectory. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

N67-27795# Royal Aircraft Establishment, Farnborough (England).
THE ORBIT OF INJUN 3 ROCKET (1962 $\beta\ \tau$ 6) FOR 20 APRIL TO 1 MAY 1966
Diana W. Scott Dec. 1966 16 p refs
(RAE-TR-66395) CFSTI: HC $3.00/MF $0.65

Orbital parameters of the Injun 3 rocket have been determined from 174 optical and radar observations, at 7 ascending nodes in late April 1966. This is a continuation of earlier determinations of the satellite's orbit in 1963–1965. Author

N67-27799 Royal Aircraft Establishment, Farnborough (England)
LONGITUDE DEPENDENCE OF THE GEOPOTENTIAL DEDUCED FROM SYNCHRONOUS SATELLITES
R. R. Allan and B. A. M. Piggott Dec. 1966 18 p refs
(RAE-TR-66397) CFSTI: HC $3.00/MF $0.65

Observations of Syncom 2 and Syncom 3 during seven separate periods of free drift were used to find the effective potential at synchronous height. Although the accelerations are well determined near the two longitudes, 180°E and 300°E, where the observations are clustered, the poor distribution in longitude does not permit a satisfactory determination of individual coefficients. It would be particularly valuable to have observations in the region 0°–40°E or around either of the two stable points near 70°E and 250°E. If there is or has been any significant population of dust particles in distant geocentric orbits, it is likely that a proportion will have been captured in the synchronous resonance, and will have accumulated near the stable positions. It is therefore suggested that it would be worth attempting to observe whether there are clouds of dust particles near the stable longitudes, and in the stable plane for synchronous height. Author

N67-27815# Bonn Univ. (West Germany). Astronomical Inst.
INVESTIGATION OF THE PROPER MOTIONS OF STELLAR CLUSTER XII–NGC 2422, NGC 2423, NGC 7209 AND AN. BARKHATOVA I IN SEL. AREA 40 [UNTERSUCHUNGEN UEBER DIE EIGENBEWEGUNGEN VON STERNHAUFEN XII NGC 2422, NGC 2423, NGC 7209 UND AN. BARKHATOVA I IM SEL. AREA 40]
Heinrich Van Schewick 1966 46 p refs In GERMAN; ENGLISH summary
(Rept.-74) CFSTI: HC $3.00/MF $0.65

An investigation is given of the relative and absolute proper motions of three open galactic clusters and their environs, using three pairs of plates each which were taken with the 5 m refractor. The cluster members are separated from the field stars, and results are compared with photometric investigations. The cluster NGC 2422 contains no yellow giants. In the cluster NGC 2423, the number of photometrically determined main sequence stars and yellow giants have been reduced. For both clusters, the epoch-differences were 57 to 62 years. The investigation of NGC 7209 with epoch-differences of 39 to 40 years shows that the main sequence is limited to a very narrow range. The cluster contains not more than three yellow giants. Proper motions are also given for stars from the Kapteyn Selected Area 40 containing the object An. Barkh. I. This object is probably not a galactic cluster. Author

N67-28001*# California Univ., Berkeley.
UPPER LIMITS ON LIQUID WATER IN THE VENUS ATMOSPHERE
W. J. Welch and D. G. Rea [1966] 9 p refs
(Contract NASr-220; Grants NsG-101-61; NsF GA-527)
(NASA-CR-84601) CFSTI: HC $3.00/MF $0.65 CSCL 03B

A consequence of the discovery of HCl and HF in the atmosphere of Venus, namely, that there cannot be much liquid water in the Venus atmosphere due to the presence of HCl, is discussed. The statement is based on microwave observations of the planet. The HCl is highly soluble in water, and the resulting acid has a high DC conductivity. If there were much of this acid in the Venus atmosphere, the long wavelength radar signals would be strongly attenuated, whereas the radar signals appear to reach the planet's surface with little attenuation. An even smaller upper limit on the liquid water content of the Venus atmosphere is obtained by another less direct argument. The microwave emission spectrum of the planet resulting from a cool acid cloud above the warm surface is considered. S.P.

N67-28003*# Illinois Univ., Urbana. Coordinated Science Lab.
RESEARCH RELATED TO AN EXPERIMENTAL TEST OF GENERAL RELATIVITY Semiannual Status Report, 1 Jul.–31 Dec. 1966
H. W. Knoebel and W. D. Compton Mar. 1967 31 p refs
(Grant NsG-443)
(NASA-CR-84370) CFSTI: HC $3.00/MF $0.65 CSCL 22A

A passive non-metallic gyroscopic earth satellite for measuring the in-plane precession predicted by general relativity is being studied. Gravity gradient torques are minimized by the combination of optimum gyroscope geometry and favorable initial alignment of the spin axis. Data are recovered by observation of flashes of solar reflection from mirrored facets on the satellite. Author

N67-28016*# Boeing Scientific Research Labs., Seattle, Wash. Mathematics Research Lab.
PHYSICAL LIBRATION OF A DEFORMABLE MOON THEORY I Semiannual Progress Report, Aug. 29, 1966–Feb. 28, 1967
C. L. Goudas and Zdenek Kopal 28 Feb. 1967 37 p refs
(Contract NASw-1470)
(NASA-CR-84662; SAPR-1) CFSTI: HC $3.00/MF $0.65 CSCL 03C

Recent data on the lunar gravity field is discussed as it pertains to the mechanical ellipticities and mass distribution of the Moon. It is tentatively concluded that the Moon departs more from hydrostatic equilibrium than was believed in the pre-Orbiter era, and that its density is almost everywhere constant with a slight increase with depth. The formulation is made from first principles of the problem of the physical librations of the Moon, which is assumed to be a compressible fluid of arbitrarily high viscosity. The case of solid bodies is covered by this formulation as a limiting case. A self-gravitating viscous mass is allowed to oscillate in an arbitrary time-dependent external field, which in the case of the Moon, will be represented by the gravity field emanating from the Earth. The solar attraction will be treated as is customary in the pertinent literature as a perturbation which can be inserted as one additional term in the right-hand side of the Eulerian equations. This term is available in closed form. Author

N67-28154 Royal Aircraft Establishment, Farnborough (England).
THE CONTRACTION OF SATELLITE ORBITS UNDER THE INFLUENCE OF AIR DRAG. PART V: WITH DAY-TO-NIGHT VARIATION IN AIR DENSITY
G. E. Cook and D. G. King-Hele Oct. 1964 80 p refs
(RAE-TR-64029) CFSTI: $3.00

The effect of air drag on satellite orbits of small eccentricity (<0.2) was studied on the assumption that the atmosphere was spherically symmetrical. In reality the density of the upper atmosphere depends on the elevation of the Sun above the horizon and has a maximum when the Sun is almost overhead. In the present paper the theory is extended to an atmosphere in which the air density at a given height varies sinusoidally with the geocentric angular distance from the maximum-density direction. Equations are derived which show how perigee distance and orbital period vary with eccentricity throughout the satellite's life, and how eccentricity varies with time. Expressions are also obtained for lifetime and air density at perigee in terms of the rate of change of orbital period. The main geometrical parameter determining the long-term effect of this day-to-night variation is the angular distance ϕ_p of perigee from the maximum-density direction. Results are obtained for ϕ_p constant and ϕ_p varying linearly with time. Author

N67-28224*# Holman (John F.) and Co., Inc., Washington, D. C.
WHAT DOES ZODIACAL LIGHT CONSIST OF? [EN QUOI CONSISTE LA LUMIERE ZODIACALE?]
J. C. Houzeau Washington, NASA, Jun. 1967 5 p refs Transl. into ENGLISH from Ciel Terre (Uccle), v. 1, 1880/1881 p 517–521
(Contract NASw-1495)
(NASA-TT-F-11034) CFSTI: HC $3.00/MF $0.65 CSCL 03B

Various hypotheses of the nature of zodiacal light and its relationship to gegenschein are discussed. Theoretical conditions attempting to compare it to comas or tails of comets are considered. Author

N67-28225*# Holman (John F.) and Co., Inc., Washington, D. C.
THE INTERRELATION OF SMALL BODIES OF THE SOLAR SYSTEM [K VOPROSU O VZAIMOSVYAZI MALYKH TEL SOLNECHNOY SISTEMY]
A. K. Terent'yeva Washington, NASA, May 1967 7 p refs Transl. into ENGLISH from Inform. Byul. Materialy Mezhdunarodanogo Geofizicheskogo Goda (USSR), no. 6, 1964 p 11–15
(Contract NASw-1495)
(NASA-TT-F-10965) CFSTI: HC $3.00/MF $0.65 CSCL 03A

The distribution of small bodies (asteroids, meteorites, comets and meteoric particles) by the magnitude of the constant (in the first approximation, h_0) of the Jacobi integral in the limited circular three-body problem is investigated. The following conclusions were reached: (1) Asteroids, meteorites and comets form, on the curve $N=f(h_0)$, pronounced independent groups in a rather narrow range h_0, while the distribution of meteoric particles is more uniform over a very wide range h_0; (2) Meteoric particles may be associated with all the above-mentioned small bodies, but primarily with short-period comets; (3) A complex and profound interrelation is found among systems of small bodies. Author

N67-28228*# Holman (John F.) and Co., Inc., Washington, D. C.
DETERMINATION OF THE RADIANTS, ALTITUDES AND VELOCITIES OF METEORS OBSERVED IN KIEV IN 1959 [OPREDELENIYE RADIANTOV, VYSOT I SKOROSTEY METEOROV NABLYUDAVSHIKHSYA V KIYEVE V 1959 g.]
Yu. N. Krivutsa, V. G. Kruchinenko, and L. M. Shul'man Washington, NASA, May 1967 9 p refs Transl. into ENGLISH from Inform. Byul. Materialy Mezhdunarodnogo Geofizicheskogo Goda (USSR), no. 6, 1964 p 25–31
(Contract NASw-1495)
(NASA-TT-F-10968) CFSTI: HC $3.00/MF $0.65 CSCL 03B

Data are presented on photographic observations of meteors. A brief description is given of the method of analyzing photographs of reference meteors for determining their radiants, altitudes, velocities and deceleration. The results are given for measurements of eight reference meteors. Author

N67-28229*# Holman (John F.) and Co., Inc., Washington, D. C.
DETERMINATION OF THE MASSES AND DENSITIES OF METEORIC BODIES BY PHOTOGRAPHIC OBSERVATIONS [OPREDELENIYE MASS I PLOTNOSTEY METEORNYKH TEL PO FOTOGRAFICHESKIM NABLYUDENIYAM 1958–1959 gg.]
Ye. V. Sandakova, A. A. Demenko, and V. V. Benyukh Washington, NASA, May 1967 7 p refs Transl. into ENGLISH from Inform. Byul. Materialy Mezhdunarodnogo Geofizicheskogo Goda (USSR), no. 6, 1964 p 20–24
(Contract NASw-1495)
(NASA-TT-F-10967) CFSTI: HC $3.00/MF $0.65 CSCL 03B

Results are presented on the determination of masses and densities of meteoric particles by photographic observations. Values are obtained for various sections of the path of the meteoric particles. The observed change in the density of the meteor body with altitude is explained by fragmentation during flight. Author

N67-28239*# Holman (John F.) and Co., Inc., Washington, D. C.
PHOTOMETRIC EFFECT OF THE NON-POINT CHARACTER OF METEORS [O FOTOMETRICHESKOM EFFEKTE NETOCHECHNOSTI METEORA]
V. A. Smirnov Washington, NASA, May 1967 5 p refs Transl. into ENGLISH from Inform. Byul. Materialy Mezhdunarodnogo Geofizicheskogo Goda (USSR), no. 6, 1964 p 16–19
(Contract NASw-1495)
(NASA-TT-F-10966) CFSTI: HC $3.00/MF $0.65 CSCL 03B

A comparision of the exact photometric profiles of meteors and stars showed that they were not comparable. Comparison of meteor images with star images leads to errors due to the physical differences between these phenomena. It is assumed that the best data on the nature of luminescence of meteors in comparison with star images may be given by the characteristic dependence of the areas of profiles on stellar magnitudes. Author

N67-28243# Lincoln Lab., Mass. Inst. of Tech., Lexington.
STABLE EQUILIBRIUM ORIENTATION OF A SPACECRAFT WHICH CONTAINS A MOMENTUM WHEEL
John U. Beusch 20 Feb. 1967 31 p refs
(Contract AF 19(628)-5167)
(TN-1967-16; ESD-TR-67-164; AD-649190) CFSTI: HC $3.00/MF $0.65

The orientation of a spacecraft when it is in a stable equilibrium state is studied. The spacecraft contains a single momentum wheel which stores angular momentum. The axis of the wheel is not necessarily parallel to a principal axis of the spacecraft. For an arbitrary but fixed speed of the wheel relative to the spacecraft body, it is shown that there may be one, two, or three stable equilibrium points. At each of these points, the body may spin about an axis which is fixed in both spacecraft and inertial coordinates. The orientation of this axis in spacecraft coordinates can be determined. A threshold can be determined such that, if the speed of the wheel relative to the spacecraft is larger than this threshold, there is only one stable equilibrium point. This information can be used to determine the eventual orientation of the spacecraft provided it is designed such that, if it becomes seriously misoriented, the momentum wheel drive motor automatically holds the wheel speed to a predetermined value. Author (TAB)

N67-28284*# National Aeronautics and Space Administration, Washington, D. C.
ORBITS OF METEOR BODIES FROM PHOTOGRAPHIC OBSERVATIONS OF 1957–1958 [ORBITY METEORNYKH TEL PO FOTOGRAFICHESKIM NABILYUDENIYAM 1957–1958 gg]
V. I. Dem'yanenko, A. K. Terent'yeva, and L. M. Sherbaum Washington, NASA, May 1967 9 p refs Transl. into ENGLISH from Materialy Mezhdunarodnogo Geof. Zicheskogo Goda, no. 6, 1964 p 20–24
(Contract NASw-1495)
(NASA-TT-F-10969) CSCL 03C

The heliocentric elements of orbits were found for 31 meteors from photographic observations. Computer calculations using floating points subprograms obtained basic data from the extra-atmospheric velocity of the meteoric body, the apparent position of the radiant, the moment of transit, the Earth's coordinates, and the Earth's velocity for the transit moment. G.G.

N67-28285*# National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.
THE PAST IS PROLOGUE TO THE FUTURE
J. C. Elms 18 May 1967 19 p
Available from the Scientific and Technical Information Division CSCL 22A

The early history of US space exploration is outlined from the first launching of scientific satellites during the International Geophysical Year up to satellite probes in the vicinity of Mars and Venus as well as soft landings of instrumented spacecraft on the Moon. Future space missions will be directed towards improvement of global communications, weather forecasting, hydrologic and geological surveys, and sensing of oceanographic and marine resources. The Apollo program especially will be developing the tools, the minds, and the strength for future and greater space enterprises. G.G.

N67-28365*# Virginia Univ., Charlottesville. Research Labs. for the Engineering Sciences.
MOMENTUM TRANSFER TO SOLID SURFACES BY N_2 MOLECULES AT SATELLITE VELOCITIES
John W. Boring Feb. 1967 34 p refs
(Contract NAS1-2538)
(NASA-CR-66372; EP-4018-139-67-U) CSCL 22A

Measurements have been made of the momentum transfer to solid surfaces by N_2 molecules in the energy range 10–200 eV, the low end of this range corresponding to satellite velocities. The results were obtained by forming a neutral N_2 beam of the appropriate energy, and then measuring the force produced by the beam on a test surface. The dependence of the results on the gross character of the surface and the angle of incidence were studied, with the measurements indicating that the interaction under the conditions of this investigation (surface state not rigidly controlled) was dominated by the gas molecules adsorbed on the surface. An investigation of the dependence of the results on angle of incidence indicates that for rough surfaces the average momentum of the reflected molecules is normal to the surface. Author

N67-28627# California Inst. of Tech., Pasadena. Owens Valley Radio Observatory.
ON THE POSSIBILITY OF SELECTING QUASI-STELLAR GALAXIES FROM BLUE STARS BY OBSERVATIONS IN THE NEAR INFRARED
Alessandro Braccesi 1967 6 p refs
(Contract N00014-67-A-0094-0008)
(Rept.-2; AD-649853) CFSTI: HC $3.00/MF $0.65

It is known that a certain fraction of the high-galactic-latitude, faint, blue 'stars' are objects with the same optical properties as the quasi-stellar sources. The possibility of selecting these objects from the white dwarfs by observations in the near infrared is shown. Author (TAB)

N67-28628# General Electric Co., Philadelphia, Pa.
HYPERSONIC DYNAMIC STABILITY. PART I: SUMMARY Final Report, May 1963–Oct. 1965
L. A. Marshall Jan. 1967 94 p refs Wright-Patterson AFB, Ohio, AF Flight Dyn. Lab., Jan. 1967 94 p refs
(Contract AF 33(657)-11411)
(FDL-TDR-64-149, Pt. I; AD-650794) CFSTI: HC $3.00/MF $0.65

The report presents a summary of the important results obtained on a combined analytical and experimental program for investigation of the hypersonic dynamic stability of re-entry vehicles. An unsteady flow field solution is described which predicts the static and dynamic stability characteristics for vehicles which are executing small amplitude oscillations about zero angle of attack. Solutions were obtained for sharp and blunted, axisymmetric and two-dimensional shapes in real gas equilibrium flow. The experimental program was conducted in AEDC tunnel 'C' at Mach 10 and in the Ling-Temco-Vought hot shot tunnel at Mach 14 and 20 to obtain dynamic stability characteristics of a 10 degree cone. Data are presented to show the effect of bluntness ratio, reduced frequency, center of gravity location, Reynolds number and Mach number. Comparisons are made with various theoretical results and limited correlations are shown which establish significant trends. Author (TAB)

N67-28713 Royal Aircraft Establishment, Farnborough (England).
DETERMINATION OF THE MOON'S GRAVITATIONAL FIELD FROM THE MOTION OF LUNA 10 [OPREDELENIE POLYA TYAGOTENIYA LUNY PO DVIZHENIYU ISKUSSTVENNOGO SPUTNIKA LUNY LUNA 10]
E. L. Akim Jan. 1967 8 p ref Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 170, 1966 p 799–802
(RAE-LIB-TRANS-1211) CFSTI: HC $3.00

Tracking data obtained over the two months active life of the artificial Moon satellite Luna 10 have been analyzed to determine the coefficients of eleven harmonics in the Moon's gravitational potential. Author

N67-28749*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SOME THOUGHTS ON UNMANNED LUNAR EXPLORATION
David Stern Jun. 1967 8 p refs
(NASA-TM-X-55806; X-641-67-268) CFSTI: HC $3.00/MF $0.65 CSCL 22A

The purpose of the work is to explore the possibility of using a manlike robot, controlled from earth, to perform relatively simple tasks which otherwise would require the presence of man.

Advantages and problems associated with the lunar exploration robot are listed, and possible means for coping with the problems are indicated. Such design aspects as handling capacity, visual inspection, locomotion, communication, control, and power sources are briefly discussed. K.W.

N67-28760*# Smithsonian Astrophysical Observatory, Cambridge, Mass.

SYSTEMATIC CORRECTIONS TO REDUCE CERTAIN SATELLITE POSITIONS TO THE FK4 SYSTEM

K. Haramundanis 14 Dec. 1966 23 p refs

(Grant NsG-87-60)

(NASA-CR-84822; SAO Special Rept.-233) CFSTI: HC $3.00/MF $0.65 CSCL 03A

Prior to the observation date September 1, 1962, all precisely reduced positions of artificial satellites were reduced with star positions from a large number of inhomogeneous star catalogs. After this date, the SAO Star Catalog has been used for all star coordinates. For the years 1962.80 to 1963.99, the star catalog in the FK3 system was in use; subsequently the catalog was put into the FK4 system. In order to bring early (prior to September 1, 1962) satellite positions into the same coordinate system as the final SAO Star Catalog (the FK4 system), it was necessary first to derive and then to apply the appropriate systematic corrections to the observed positions. This paper presents a brief discussion of the typical errors to be found in star catalogs, and uses the standard (Newcomb) method for deriving the systematic corrections. A complete table of the corrections is included, with an explanation for its use. Author

N67-28762*# Analytical Mechanics Associates, Inc., Lanham, Md.

ADAPTIVE FILTERING Interim Report

Andrew H. Jazwinski and Ann E. Bailie Mar. 1967 23 p refs

(Contract NAS5-9085)

(NASA-CR-84794; Rept.-67-6) CFSTI: HC $3.00/MF $0.65 CSCL 22C

Model inaccuracies are here approximated by a Gaussian white noise input, and its covariance (Q) is determined so as to produce most probable sequences of residuals. The method is desirably non-Bayesian and adaptive, with direct feedback from the residuals. An explicit solution to the problem of when, and how much, Q to add is given. Author

N67-28768*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

INTERACTIONS OF SPACECRAFT AND OTHER MOVING BODIES WITH NATURAL PLASMAS

Carol K. Sterkin, comp. Dec. 1965 185 p refs *Its* Lit. Search No. 541

(Contract NAS7-100)

(NASA-CR-84819) CFSTI: HC $3.00/MF $0.65 CSCL 22A

A bibliography with abstracts is presented on the interactions of moving satellites, rockets, and missiles with the surrounding ionosphere, magnetosphere, and interplanetary plasma. Emphasis is placed on magnetic and electrical phenomena, and on electrical hazards to the spacecraft. The majority of the references concern spacecraft phenomena and related ionospheric instrumentation and data. The areas covered are: spacecraft, aircraft, small projectiles, celestial bodies, interplanetary matter, ionospheric research, and related subjects. N.E.N.

N67-28772# Analytical Mechanics Associates, Westbury, N. Y.

THE PROBABILITY OF MISSION SUCCESS (POMS) PROGRAM

W. Denham and J. Mohan Oct. 1965 25 p refs

(Contract NAS5-9085)

(NASA-CR-84815) CFSTI: HC $3.00/MF $0.65 CSCL 22C

Techniques were developed, and a computer program prepared and tested, for choosing trajectory parameters to maximize the probability of success of a mission directly. The statistical distribution of perturbed trajectories, as well as the nominal trajectory itself, depend on the nominal trajectory parameters. The mission probability of success is thus completely determined by the input statistics, assumed specified, and the nominal trajectory parameters. The principal advantage is that it is not necessary to do Monte Carlo simulations to calculate the probability of success. This indicates an order of magnitude reduction in computing time. To optimize the trajectory parameters it is necessary to use a successive improvement scheme, changing the parameters each iteration to produce a modest increase in the success probability. The gradient program allows optimization of a particular translunar mission, although all the structure and most of the equations are included for any open-loop space mission. The program is also suitable for the addition of orbit determination and feedback control system equations. Author

N67-28774*# Litton Systems, Inc., Minneapolis, Minn. Applied Science Div.

STUDIES OF EXTRATERRESTRIAL DUST AT 40 KILOMETERS (1966) Final Report

R. Wood, H. Zeller, R. Olson, R. Deeter, K. Maffitt et al 1 Feb. 1967 57 p refs

(Contract NASw-1395)

(NASA-CR-84811) CFSTI: HC $3.00/MF $0.65 CSCL 22A

A balloon-borne sampling probe was launched to an altitude of 42.6 km to demonstrate the feasibility of acquiring large samples of extraterrestrial dust and to explore the possibilities for particle analysis by electron microscope, electron mirror microscope, electron microprobe, and nuclear magnetic resonance. Submicron particles were found and noted to be concentrated in a sharply defined track corresponding to the location of the impactor jet above the collection surface. Electron microscope studies indicate that the sample consisted of optically dense irregular spheroids having a number mean diameter on the order of 0.1 micron and that they were hydroscopic. Over 95% of the particles were found to be nonconductors, and none were found to have magnetic properties. The evidence of potassium, chlorine, and lead indicated gas leakage when the squib was fired. N.E.N.

N67-28775*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.

A HARMONIC L_4 ORBIT FOR THE VERY RESTRICTED FOUR-BODY PROBLEM

Ronald Kolenkiewicz and Lloyd Carpenter [1966] 17 p refs

(NASA-TM-X-59818) CSCL 03C

A method of general perturbations utilizing Chebyshev series is used to investigate motion in the vicinity of the L_4 triangular point of the earth–moon system. The model used is that of the very restricted four-body problem for the earth–moon–sun system. A harmonic orbit, in the numerical sense, with respect to a rotating coordinate frame centered at L_4 is found. The period of this harmonic orbit, being equal to the period of the disturbing force, is the same as the moon's synodic period. This orbit remains within 6860 km of the L_4 point. It describes two different size loops about L_4, the smaller one traversed in 36 percent of the period. The disturbing force, being nearly periodic with half the moon's synodic period, gives rise to another orbit about L_4 which is nearly periodic with half the synodic period of the moon. This orbit remains within 4574km of the L_4 point for twelve periods investigated. Deviations from the mid orbit during this time is less than 381km. Author

N67-28785*# Pittsburgh Univ., Pa. Dept. of Physics.

THE PROBLEM OF USING MARINER IV IONOSPHERIC DENSITIES TO DEDUCE A MODEL OF THE MARTIAN ATMOSPHERIC STRUCTURE

T. M. Donahue 7 Apr. 1967 24 p refs Presented at the Conf. on the Atmospheres of Mars and Venus, Kitt Peak Natl. Lab., Feb. 1967
(Contract NASr-179)
(NASA-CR-84825; SRCC-41) CFSTI: HC $3.00/MF $0.65 CSCL 04A

An F_1 layer maximum would apparently occur fifteen kilometers too high in the Martian ionosphere even though the atmosphere were pure CO_2 in a model with high temperature mesopause and thermopause. It is pointed out, however, that a similar calculation of electron densities in the earth's ionosphere starting with a reasonable model for neutral structure and temperature would also disagree with the observed profile of electron density in the F_1 region. It is argued that where no ionospheric model based on unforced assumptions manifestly supports any atmospheric model it is unreasonable to rely on ionospheric properties to discriminate between models. Author

N67-28797*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SPACE TRAJECTORIES AND ERRORS IN TIME, FREQUENCY, AND TRACKING STATION LOCATION
F. O. Vonbrun Apr. 1967 19 p refs
(NASA-TM-X-55798; X-507-67-163) CFSTI: HC $3.00/MF $0.65 CSCL 22C

Two systems, which data are presently used for most of the more accurate orbit determination schemes, are described, namely, (a) a range and range rate system and (b) a radar system. Rather simple analytical expressions are derived relating measuring errors with those of time and frequency synchronization, as well as ground tracking station location. For the range and range rate system, the error in range rate ($\delta\dot{r}$=0.01 cm/s) is used as a yardstick and all other quantities are derived from it. For the radar system (not measuring range rate directly), the total local position vector, as measured by such a system, is used as the yardstick to determine the necessary time synchronization and station location accuracy. Numerical examples are presented which show what accuracies of the mentioned quantities are needed for a good ground tracking system to make its data most useful for the determination of accurate orbits and space trajectories. Author

N67-28800*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MULTIPLE MIDCOURSE MANEUVERS IN INTERPLANETARY GUIDANCE
Abolghassem Ghaffari Jun. 1966 16 p refs
(NASA-TM-X-55788; X-507-66-254) CFSTI: HC $3.00/MF $0.65 CSCL 22C

The number and location of midcourse maneuvers in an interplanetary mission were investigated. The case of a flyby Jovian mission with a spin stabilized spacecraft is considered. The mission objectives are a flyby within 10^6 km (6 diameters) of the planet Jupiter and a flight time from earth to Jupiter of 500 days. The spacing-ratio method was applied and it is shown that a constant spacing-ratio of 2.5 for the velocity-sensitivity leads to a near optimum spacing of correction times. Author

N67-28822*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
A NUMERICAL THEORY OF SATELLITES IN BRENDEL'S COORDINATES
Peter Musen Washington, D. C., Jun. 1967 21 p refs
(NASA-TN-D-4002) CFSTI: HC $3.00/MF $0.65 CSCL 22C

A form of the numerical lunar theory is suggested for planetary satellites moving in orbital planes with higher inclinations relative to the orbit plane of the Sun. The number of terms given explicitly in final solutions is too small to warrant the noncritical application of the written portions of the series to the cases of higher inclinations. In addition, the convergence of these series is slow near resonance angles. Convergence problems can be remedied in part by arranging the theory in such a way that the squares of the mean motions of the perigee and node are determined instead of the first powers of these motions. Brendel's coordinates are used, and the equations of motion are reduced to the problem of two disturbed linear oscillators. Following Hansen the numerical values of all the basic parameters of the lunar theory are substituted from the outset and the process of iteration is used to solve the problem. The mean orbital plane and the constants of integration are chosen in such a way that the expansions of the coordinates contain only purely periodic terms. The polar angle v of the projection of the satellite on the mean orbital plane is the independent variable of the theory. With this choice of the independent variable, the differential equations of the problem become the equations for linear oscillators. Author

N67-28832*# IIT Research Inst., Chicago, Ill.
ON THE PROBLEM OF COMET ORBIT DETERMINATION FOR SPACECRAFT INTERCEPT MISSIONS
Alan L. Friedlander May 1967 89 p refs
(Contract NASr-65(06))
(NASA-CR-84848; T-19) CFSTI: HC $3.00/MF $0.65 CSCL 22C

Optimal linear estimation theory is applied to the problem of determination and prediction of cometary motion and, in particular, to the short period comets, Encke and D'Arrest. The numerical study of cometary motion is facilitated by a high precision Orbit Determination Program developed for use on the IBM 7094 computer. The computer program is basically an N-body trajectory integration code which includes the gravitational perturbation effects of all the solar system planets and also non-gravitational or secular perturbations unique to the nature of comets themselves. Past observations of comet Encke are obtained for 7 appearances over the period 1931–1961 with no less than 3 observations in each appearance. Results of data fitting show strong evidence of a secular acceleration of mean motion. The average effect over the interval studied causes a decrease in the orbital period of about −0.02 day/orbit. In the case of a 1974 mission to Encke and a 1976 mission to D'Arrest, it is shown that miss distances under 10,000 km cannot be achieved unless the comets are observed in the year of launch. Author

N67-28833*# IIT Research Inst., Chicago, Ill.
PRELIMINARY PAYLOAD ANALYSIS OF AUTOMATED MARS SAMPLE RETURN MISSIONS
John C. Niehoff May 1967 146 p refs
(Contract NASr-65(06))
(NASA-CR-84849; M-13) CFSTI: HC $3.00/MF $0.65 CSCL 22A

A payload analysis is presented for the unmanned or automated collection of a sample of the Martian surface and its return to Earth. The study objective was to identify by preliminary analysis mission modes which could be launched in the mid-1970's by a single Saturn V vehicle if available chemical propulsion systems were used throughout the mission. Twelve candidate mission modes are formulated from an analysis of many mission phase options. Four of these modes are shown to satisfy study constraints and have payload requirements within the capability of a single Saturn V launch vehicle. Three of the four modes are one year Mars stay time, 975 day round trip missions. The fourth possible mode is a 12 day stay time, 550 day round trip mission with a Venus swingby return transfer. The near-Mars orbital maneuvers are out-of-orbit entry/escape via rendezvous. Author

N67-28875*# Volt Technical Corp., Washington, D. C.
POSSIBLE INTERPRETATION OF THE RESULTS OF MEASUREMENTS ON THE NEAR-LUNAR SATELLITE "AMS LUNA-10" [VOZMOZHNAYA INTERPRETATSIYA REZUL'TATOV IZMERENIY NA OKOLOLUNNOM SPUTNIKR LUNA-10]
Sh. Sh. Dolginov, E. G. Yeroshenko, L. N. Zhuzgov, and I. A. Shulin 2 Jun. 1967 12 p refs Transl. into ENGLISH from Russian
(Contract NAS5-12487)
(NASA-CR-84837; ST-LPS-NLS-10618) CFSTI: HC $3.00/MF $0.65 CSCL 22A

The nature of the near-lunar field and the possibility of detecting the earth's magnetic tail in connection with the results of magnetic and plasma measurements in the vicinity of the moon on the artificial satellite Luna-10 are discussed. Author

N67-28919# RAND Corp., Santa Monica, Calif.
COMMERCIAL UTILIZATION OF SPACE: SOME ASPECTS OF A POSSIBLE FUTURE
Kenneth B. Bley and Russell D. Shaver Apr. 1967 14 p
(P-3565; AD-650473) CFSTI: HC $3.00/MF $0.65

A discussion of the relevance of reusable launch vehicles to the future of space travel is followed by a discourse on the possible impact of future space projects on labor, education, population distribution, clothing, women, minority groups, arts, and religion. TAB

N67-28921*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A STUDY OF BALLISTIC REENTRY TRAJECTORIES AT A VELOCITY OF 50,000 FEET PER SECOND (15,240 METERS PER SECOND)
John T. Suttles and Lucille C. Coltrane Washington, NASA, Jun. 1967 85 p refs
(NASA-TN-D-4011) CFSTI: $3.00 CSCL 22C

Results of calculations of ballistic trajectories with an initial velocity of 50,000 ft/sec are presented for initial reentry angles from about -5° to -25° and for values of the ballistic coefficient from 10 to 200 lbf/ft^2. The data show three types of trajectories: skip-out trajectories, skipping reentry trajectories, and direct reentry trajectories. The altitude-velocity profiles of these ballistic trajectories are compared with the profile of a typical lifting trajectory for a return from a manned interplanetary mission. Results indicate that a good ballistic simulation of the initial portion of the altitude-velocity profile of the lifting trajectory can be obtained for a skip-out trajectory with values of the ballistic coefficient between 100 lbf/ft^2 and 200 lbf/ft^2. A reasonable simulation can be obtained for a direct reentry trajectory with values of the ballistic coefficient of less than 100 lbf/ft^2. In a simulation the trajectory dispersions may be significantly reduced for the direct reentries by judicious selection of the values of ballistic coefficient and initial reentry angle whereas, for the skip-out trajectories, acceptable dispersions can be obtained only by requiring high accuracy in the initial reentry angle. The skipping reentry trajectories have long horizontal ranges and large dispersions. Author

N67-28922# Royal Aircraft Establishment, Farnborough (England).
THE ORBITS OF LUNAR SATELLITES: AN INTRODUCTION
G. E. Cook Dec. 1966 23 p refs
(RAE-TR-66398) CFSTI: HC $3.00/MF $0.65

Present knowledge of the moon's gravitational field is briefly reviewed. The report then describes the main perturbations of the orbit of a lunar satellite caused by low-order terms in the lunar gravitational potential and by the earth. Techniques for investigating the lunar potential are outlined. Author (ESRO)

N67-28923# Royal Aircraft Establishment, Farnborough (England).
ORBIT DETERMINATION FROM MINITRACK OBSERVATIONS
R. H. Gooding Nov. 1966 19 p refs Presented at the Roy. Soc. Meeting on Orbital Anal., 17–18 Oct. 1966
(RAE-TR-66360) CFSTI: HC $3.00/MF $0.65

Although Minitract observations are only accurate to about 1 min. of arc, accurate orbits have been obtained for a number of satellites. This is due to the excellent global coverage of the NASA Minitrack network. The accuracy obtained for eccentricity is typically about 10^{-5}, and comparable values are obtained for the other orbital elements. The main source of observational error is thought to be inadequate correction for ionospheric refraction. Apparent error arises through deficiencies in the orbital model, namely, inadequate representation of satellite perturbations due to the earth's tesseral harmonics and to atmospheric drag. Author (ESRO)

N67-28928*# California Univ., Los Angeles.
THE CHEMICAL COMPOSITION OF NORMAL STELLAR ATMOSPHERES
Lawrence H. Aller [1966] 5 p
(Grant NGR-05-007-046)
(NASA-CR-84882) CFSTI: HC $3.00/MF $0.65 CSCL 03B

Difficulties in the spectroscopic determination of the chemical composition of stellar atmospheres are discussed. Three methods of analysis are described. In the conventional curve of growth procedure the equivalent width of the line (log W/λ) is plotted against some function gfA, where A is the abundance, g is the statistical weight of the lower level, and f is the transition probability. In the method of model atmospheres, log W/λ is plotted against some function of gfA, but the stratification of the atmosphere is taken into consideration, i.e., the variation of temperature, pressure, and absorption coefficients with depth in the stellar atmosphere. If high quality observational material is available, individual line profiles can be calculated. The disadvantages of these methods are discussed along with some examples of their applications. Some efforts to further refine the methods of analysis are mentioned. R.N.A.

N67-28930*# General Precision, Inc., Little Falls, N. J. Aerospace Research Center.
BIRKHOFF NORMALIZATION PROCESS PROGRAM FOR TIME-INDEPENDENT HAMILTONIAN SYSTEMS
W. A. Chai and S. Kass Oct. 1966 45 p refs
(Contracts NAS8-20062; AF 49(638)-1466)
(NASA-CR-84880; AFOSR-67-0123; AD-647194) CSCL 03C

This a complete documentation (program description) of a computer package for analyzing finite time stability properties of equilibrium points of time-independent Hamiltonian systems. Using this package, approximate analytic solutions which contain nonlinear effects can be constructed near these equilibrium points. Three main programs constitute the complete package. The first program normalizes and computes the generating functions for a time-independent Hamiltonian in the neighborhood of an equilibrium point, the second expresses coordinate transformations as truncated power series, and the third program computes point-by-point coordinate transformations as truncated power series, and the third program computes point-by-point coordinate transformations. To demonstrate the procedure, the report describes in detail the application of the computer package to the construction of solutions of the planar restricted three-body problem near the L_4 equilibrium point. Numerical results compare very favorably in precision with values obtained by numerical integration. The computer time required for the entire normalization process is only a small fraction of the integration time, however. Author (TAB)

N67-28951# Boeing Scientific Research Labs., Seattle, Wash. Mathematics Research Lab.
THE TROJAN MANIFOLD IN THE SYSTEM EARTH–MOON

A. Deprit, Jacques Henrard, Julian Palmore, and J. F. Price Feb. 1967 51 p refs *Its* Mathematical Note No. 506
(D1-82-0604; AD-651147) CFSTI: HC $3.00/MF $0.65

The Trojan manifold is defined as the analytical manifold of periodic orbits which contains the triangular equilibrium L4 as a singularity. Identification of the Earth-Moon system is made to a planar Restricted Problem of Three Bodies. The barycentric synodical coordinate system and the units of length, time and mass are chosen as defined by Wintner; the mass ratio is taken equal to about 0.012150. For this value, the triangular configuration of equilibrium, usually denoted by L4, is stable, and it generates two natural families of periodic orbits. Author (TAB)

31 SPACE VEHICLES

Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics.

N67-27927# European Space Vehicle Launcher Development Organization, Paris (France). Basic Techniques Div.
CLASSIFICATION OF MISSIONS EFFECTED BY SPACE VEHICLES LAUNCHED IN THE U.S.S.R. [CLASSIFICATION DES MISSIONS DES VEHICULES SPATIAUX LANCES EN U.R.S.S.]
M. Gilli Mar. 1965 23 p refs In FRENCH
(ELDO-TM-F-16) CFSTI: HC $3.00/MF $0.65

The successful missions effected by space vehicles in the U.S.S.R. up to 1964 inclusive are cited in table form and an attempt is made to evaluate the present Soviet launchers. ESRO

N67-27932# European Space Vehicle Launcher Development Organization, Paris (France). Basic Techniques Div.
SPACE VEHICLE LAUNCHERS IN THE UNITED STATES [LES LANCEURS DES VEHICULES SPATIAUX DES ETATS UNIS]
M. Gilli Sep. 1965 48 p In FRENCH Revised
(ELDO-TM-F-20) CFSTI: HC $3.00/MF $0.65

Principle characteristics and performances of American launchers used at present or being in project are given in table form. Author (ESRO)

N67-27936# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
ON THE DEVELOPMENTAL WORK OF A RECOVERABLE SOUNDING ROCKET PROJECT 621 [BERICHT UEBER DIE ENTWICKLUNGSARBEITEN AN EINER RUECKFUEHRBAREN HOEHENFORSCHUNGSRAKETE]
W. Pittelkow [1966] 16 p In GERMAN; ENGLISH summary Presented at the Ann. Joint Meeting DGRR/WGLR, Bad Godesberg, W. Germany, Oct. 1966
(DGRR/WGLR Paper-66-057) CFSTI: HC $3.00/MF $0.65

For the recovery of sounding rockets the paraglider (flex wings) has been selected and investigated. On the apogee of the rocket trajectory two rigid booms will unfold which are stored along the rocket during ascent. Between these booms and the rocket body high temperature resistant fabrics form conical half shells after entering denser air. Stabilization and guidance is effected by the fins. The system has been successfully tested by dropping unpowered full scale rockets from a helicopter and the guided recovery to a preselected point. For the next development step it is planned to fire rockets to 250,000 ft and guide them safely back to earth. Author (ESRO)

N67-27940# European Space Vehicle Launcher Development Organization, Paris (France). Future Programs Directorate.
CLASSIFICATION OF MISSIONS EFFECTED BY SPACE VEHICLES LAUNCHED IN THE UNITED STATES [CLASSIFICATION DES MISSIONS DE VEHICULES SPATIAUX LANCES AUX ETATS UNIS]
M. Gilli Jan. 1965 24 p In FRENCH
(ELDO-TM-F-14) CFSTI: HC $3.00/MF $0.65

The principal successful missions effected by American launchers as well as all the satellites and probes launched by NASA (except for certain military missions for which no data are available) are cited in table form. ESRO

N67-28017*# Volt Technical Corp., Washington, D. C.
WHERE IS THE DANGER HIDDEN? APROPOS THE CAPE KENNEDY TRAGEDY
Yuriy Marinin 6 Feb. 1967 4 p Transl. into ENGLISH from USSR Press Circ. 1.II.67 APN
(Contract NAS5-12487)
(NASA-CR-84671; ST-PR-10559-SP) CFSTI: HC $3.00/MF $0.65 CSCL 22B

A Soviet press circular pertaining to the fire which took the lives of Virgil Grissom, Edward White, and Roger Chaffee is presented. Backgrounds of the three astronauts are reviewed, and possible causes of the catastrophe are cited. Substitutes for the Apollo crew are named. S.P.

N67-28221*# Holman (John F.) and Co., Inc., Washington, D. C.
OPTIMAL ACOUSTIC ENVIRONMENT FOR SPACECRAFT CABINS [NEKOTORYYE VOPROSY FORMIROVANIYA OPTIMAL'NOY AKUSTICHESKOY SREDY V KABINAKH KOSMICHESKIKH KORABLEY]
Ye. M. Yuganov, Yu. V. Krylov, and V. S. Kuznetsov Washington, NASA, Jun. 1967 9 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Ser. Biol. (Moscow), v. 31, no. 1, 1966 p 14–20
(Contract NASw-1495)
(NASA-TT-F-10980) CFSTI: HC $3.00/MF $0.65 CSCL 22B

The problem of the habitability of manned spacecraft designed for extended missions cannot be solved without the establishment of permissible limits for noises affecting the crew. Experiments have shown that a sustained 30-day exposure to noises totaling 60–65 dB can be considered permissible. It is pointed out that the establishment of the minimum threshold of acoustic stimuli is urgent. To prevent an adverse psycho-acoustic effect by monotonous noise, it is recommended that the range of its amplitude and frequency be changed, while maintaining constant the level of its loudness which, as calculated, should not exceed 58–60 phons. Author

N67-28263# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
OPTIMAL PROGRAMMING OF THRUST DIRECTION OF A BALLISTIC ROCKET MOVING IN THE ATMOSPHERE [OPTIMAL'NOYE PROGRAMMIROVANIYE NAPRAVLENIYA TYAGI BALLISTICHESKOY RAKETY, DVIZHUSHCHEYSYA V VOZDUKHE]
P. Bradeanu 20 Dec. 1966 18 p refs Transl. into ENGLISH from Rev. Mecan. Appl., Acad. RPR (Rumania), v. 9, no. 1, 1964 p 213–225
(FTD-TT-65-1753; TT-67-61390; AD-649403) CFSTI: HC $3.00/MF $0.65

The article analyzes the motion of a ballistic missile moving in the atmosphere. It is assumed that there is friction due to the motion of the missile through the atmosphere, and that this force is directly proportional to the speed of the missile projected on a plane parallel to the direction of the gravitational force. With the help of formulas developed in the article, the horizontal distance of the flight can be calculated. Next, the conditions which assure

a maximum flight distance are stated in the form of partial differential equations. The general equations are applied to the cases where the thrust of the rocket is constant and where the rocket moves with constant acceleration. The method used to arrive at the optimum direction of thrust (optimality in the sense of maximum range) is due to D. Lauden. The results of the paper show that the optimal conditions of thrust direction in the case of constant acceleration is for the thrust to be constant, as is the case with a ballistic missile moving in a vacuum. Author (TAB)

N67-28363# Royal Aircraft Establishment, Farnborough (England).
NUTATIONAL STABILITY OF MULTI-BODY SPIN-STABILIZED SATELLITES
W. G. Hughes Jan. 1967 14 p refs
(RAE-TR-67009) CFSTI: HC $3.00/MF $0.65

Conditions are derived for the nutational stability (i.e., for the state of motion to converge to the desired simple spin condition) for multi-body vehicles, relative rotations of the bodies being permitted about a common axis, which is also the desired spin axis. Simultaneous energy dissipation (or injection) in all bodies is covered, confirming ideas which could only be conjectured from previous work. In particular it is shown that moment of inertia ratios will normally be unimportant if the nutation damper (assumed dissipative) is mounted on a 'de-spun' platform. This permits flexibility of design in satellites which are essentially three-axis stabilized but have, by the provision of a spinning part, the desirable features of a spin-stabilized vehicle. Author (ESRO)

N67-28379* Lockheed Missiles and Space Co., Sunnyvale, Calif.
LAUNCH VEHICLE OPTIMIZATION STUDY Final Report
Mar. 1967 138 p refs
(Contract NAS1-6395)
(NASA-CR-66345) CSCL 22D

A dual-loop gradient optimization method is described which was developed to solve design synthesis problems on large multiple stage liquid propellant launch vehicles. The procedure was mechanized in a digital computer program that incorporates an advanced version of the Presto trajectory optimization routine. This program was applied to a series of model liquid launch vehicle design problems using radically simplified equations for the relationships between the design and the jettison weights. A convergence study was conducted to investigate problems encountered with the system optimization computer program. The gradient optimization problem was reduced to a problem in two controls and a high speed computer routine was used to investigate the behavior of various gain selection and nonlinear approaches. Brief convergence studies were also completed using the system optimization computer program. Most of the gain selection and nonlinear techniques investigated demonstrated substantial improvements in convergence on selected problems. None of the techniques demonstrated consistently superior behavior on all problems over that of the original gradient routine. Author

N67-28681# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PENDULUM IN CABIN OF ARTIFICIAL EARTH SATELLITE [MAYTNIK V KALINE ISKUSSTVENNOGO SPUTNIKA ZEMLI]
A. I. Lur'ye 23 Jan. 1967 13 p refs Transl. into ENGLISH from Vopr. Dinam. i Prochnosti (Riga), no. 10, 1963 p 13–20
(FTD-TT-65-1563; TT-67-61599; AD-650808) CFSTI: HC $3.00/MF $0.65

The transfer of the classical pendulum problem into the peculiar weightless environment of an artificial earth satellite may be of both theoretical and practical interest. Consequently, starting from appropriate differential equations, the author discusses the motion of a plane pendulum (the case of the spherical pendulum was studied earlier by J. L. Synge (Proc. of Roy. Irish Acad., Vol. 60, 1961, No. 1)) and the motion of a heavy sphere along a straight groove. He shows that by using measurements on properly oriented grooves one should, in principle, be able to determine the direction of the vertical, the distance from the center of the earth, the angular velocity vector, and the nongravitational acceleration within the artificial satellite. Author (TAB)

N67-28709# Royal Aircraft Establishment, Farnborough (England).
DETERMINATION OF A ROCKET'S ATTITUDE BY A PROGRESSIVE METHOD USING TWO REFERENCE VECTORS [DETERMINATION DE L'ATTITUDE D'UNE FUSEE PAR UNE METHODE PROGRESSIVE UTILISANT DEUX VECTEURS DE REFERENCE]
F. Bertin Nov. 1966 21 p refs Transl. into ENGLISH from Astronaut. Acta (Vienna), v. 9, no. 5–6, 1963 p 371–384
(RAE-LIB-TRANS-1183) CFSTI: HC $3.00/MF $0.65

The first part shows how it is possible to determine, using only three magnetic sensors, a rocket's attitude progressively. The indetermination of the problem is removed by introducing a supplementary equation characteristic of each phase of the flight. Because of this, automatic calculation on a digital computer can be carried out. A calculation of errors is shown at the end of this chapter. The second part shows how supplementary additional information from a solar cell, the design of which is described, permits the determination of the rocket's position in space at certain special times t_i. It is deduced from this that it is possible to begin reconstructing the attitude at any one of these times t_i by using the progressive method described in the first part, despite possible technical failures. Author

N67-28711# Deutsche Versuchsanstalt für Luft- und Raumfahrt, Porz (West Germany).
INVESTIGATION ON THE COOLING OF EXHAUST GAS BY DIRECT CONTACT BETWEEN EXHAUST GAS AND WATER [UNTERSUCHUNG UBER ABGASKUHLUNG BEI DIREKTEM KONTAKT ZWISCHEN ABGAS UND WASSER]
H. Felder and J. Herzke Mar. 1967 84 p refs In GERMAN; ENGLISH summary
(DLR-FB-67-15; DVL-622) CFSTI: HC $3.00/MF $0.65

Cooling and dehydration of exhaust gases by direct contact with water at pressures around 0.1 ata were investigated in models of coolers with water admission by perforated sheets or fullcone-nozzles. The gas was cooled down from 1500°C to 25°C and dehydrated at low temperatures from 1 kg water vapor per kg inert gas to 0.12 kg/kg. Dehydration and cooling effects were better in coolers with cone-nozzles than in coolers with perforated sheets. Precooling of the hot exhaust gases resulted in somewhat lower pressure losses in the cooler but, on the other hand, the gas humidity at the cooler exit was higher, thus effecting a higher load on the coupled suction equipment. Author

N67-28714# Royal Aircraft Establishment, Farnborough (England).
INVESTIGATIONS INTO A METHOD FOR THE OPTICAL ESTIMATION OF THE ROTATION AXIS OF ARTIFICIAL SATELLITES [UNTERSUCHUNGEN UBER EINE METHODE ZUR OPTISCHEN BESTIMMUNG DER ROTATIONSACHSE KUNSTLICHER SATELLITEN]
R. H. Giese Jan. 1967 44 p refs Presented at the Comm. 7, Berlin, 10 Nov. 1964
(RAE-LIB-TRANS-1212)

A method is described for determining the orientation of the rotation axis of a spin-stabilized satellite, fitted with reflecting surfaces parallel to the axis, from observations of flashes of reflected sunlight. The conditions in which such flashes may be observed are set out, and some typical visibility patterns have been worked out and are shown in the form of maps. The errors to be expected are discussed in detail, and for most cases the direction of the spin axis may be determined to within ±0.5°. Author

N67-28766*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
BAKER–NUNN PHOTOGRAPHY OF THE INTELSAT 2-F2 APOGEE-MOTOR FIRING
20 Mar. 1967 11 p *refs*
(Grant NsG-87-60)
(NASA-CR-84799; SAO Special Rept.-237) CFSTI: HC $3.00/MF $0.65 CSCL 22B

The insertion of Intelsat 2-F2 into synchronous orbit was simultaneously photographed by three Baker–Nunn cameras, confirming apogee-motor firing. A triangulation was performed that located the position of the satellite at the time of the firing. Author

N67-28838*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
TECHNICAL DATA ON THE DEVELOPMENT OF THE A4(V-2)
H. A. Schulze 25 Feb. 1965 81 p
(NASA-TM-X-59820) CFSTI: HC $3.00/MF $0.65 CSCL 22D

This report was compiled from documentation on Peenemuende which was brought to the U. S. The present report contains the significant items pertaining to "Technical Data on the Development of the A-4(V-2)." The material is arranged in three sections. The first section begins with real early, primitive sounding rockets (A-1 thru A-3) and closes with the forerunner of the V-2(A-5). The middle and basic portion of this book deals only with the A-4(V-2) by showing the development of components, diagrams, test and launch facilities as well as some pictures of A-4 launchings. Section two closes with some data on an improved A-4, the A-4b, which had wings attached to the body. The third and last portion of the book emphasizes available information on technical capabilities and trends of further developments after the A-4, from the A-6 through the A-10. None of the data in this final section beyond the A-4 was ever pursued beyond the drawing board stage. Author

N67-28862# Royal Aircraft Establishment, Farnborough (England).
THE FIRST ARTIFICIAL MOON SATELLITE—LUNA 10
3 May 1966 13 p
(RAE-LIB-TRANS-99) CFSTI: HC $3.00/MF $0.65

Progressive news reports issued subsequent to the launching of Luna 10 are presented. The basic purpose of the automatic station carried by the rocket was to test systems on an artificial moon satellite and to test the on-board systems for injecting the station into a selenocentric orbit. Uses of Luna 10 for studying meteors, heat characteristics, and lunar magnetic and gravitational fields are briefly discussed. The flight trajectory of the space vehicle is also considered. The initial scientific findings are cited, and a diagram of the automatic station is included. S.P.

N67-28874*# Volt Technical Corp., Washington, D. C.
THE SPACE SYSTEM "METEOR" SERVES METEOROLOGISTS
8 Jun. 1967 4 p Transl. into ENGLISH from Pravda (Moscow), 4 Jun. 1967
(Contract NAS5-12487)
(NASA-CR-84836; ST-PR-10622) CFSTI: HC $3.00/MF $0.65 CSCL 22B

A news communique is presented on the orbiting meteorological satellites Cosmos 144 and Cosmos 156. The instrumentation and functional systems are outlined, and the reception, deciphering and processing of the meteorological data are mentioned. N.E.N.

N67-28900# Air Force Cambridge Research Labs., Bedford, Mass.
SUMMARY OF AFCRL ROCKET AND SATELLITE EXPERIMENTS (1946–1966)
A. McIntyre Dec. 1966 65 p *Its* Spec. Rept.-54
(AFCRL-66-868; AD-649333) CFSTI: HC $3.00/MF $0.65

The report provides a chronological summary listing of all rocket- and satellite-borne scientific experiments conducted by Air Force Cambridge Research Laboratories (AFCRL) and its contractors since the inception of the AFCRL Rocket and Satellite Program in 1946. The record, in tabular form, is a chronological listing of: the launch date, launch site, type of rocket or satellite used, an experiment descriptor, cognizant AFCRL scientist, degree of success of the experiment, and cause of failure if applicable. TAB

N67-28929*# Volt Technical Corp., Washington, D. C.
HIGHLIGHTS OF PRESS RELEASES ON THE "SALON DU BOURGET"
31 May 1967 8 p Transl. into ENGLISH from Pravda (Moscow), 27 May 1967 and from Le Monde (Paris), 27 May 1967
(Contract NAS5-12487)
(NASA-CR-84881; ST-PR-10616) CFSTI: HC $3.00/MF $0.65 CSCL 22B

Soviet and French press releases are presented which describe the Soviet exhibits of spacecraft, satellites, and launch vehicles at the 27th International Aeronautical and Astronautical Exhibit in Paris. The French article compares some of the Soviet spacecraft with their American counterparts. R.N.A.

N67-28980# RAND Corp., Santa Monica, Calif.
SATELLITES AND FUTURE COMMUNICATIONS, INCLUDING BROADCAST
J. L. Hult Apr. 1967 23 p Presented at the 13th Ann. Meeting of the Am. Astronautical Soc., Dallas, 1–3 May 1967
(P-3477; AD-650343) CFSTI: HC $3.00/MF $0.65

The investigation revealed that the large, versatile, high-gain antennas that can be boosted to, and erected in, the compellingly attractive environment of synchronous orbits are technologically feasible. The accurate, long-life control of these antennas in both attitude and orbit will enable us to increase satellite relaying capacity by tens of millions of times and multiply the effective available spectrum by hundreds to thousands of times. This could support an unprecedented increase in the application of electronic communications. It could provide a relaying cost-rate competitive with the shortest microwave relay, a much more beneficial usage of the spectrum, and a variety of capabilities not otherwise available. It becomes economically attractive only when large capacities are used, in which case it may have a serious impact on current systems and investments. The technology should also make possible satellite TV broadcast directly to homes at UHF frequencies with better quality signals at less broadcast cost than with conventional transmitters. However, transmission of broadcast programs with a general multipurpose broadband access to the home through central exchanges may prove to be the most appropriate means of distributing the bulk of future broadcast-like programs. TAB

32 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

N67-27790 Royal Aircraft Establishment, Farnborough (England).
DERIVATION OF NATURAL FREQUENCIES AND MODES FROM A RESONANCE TEST USING IMPERFECT EXCITATION [RECONSTITUTION DE FORMES ET FREQUENCES PROPRES A PARTIR D'UN ESSAI DE VIBRATIONS EFFECTUE AVEC UNE EXCITATION NON EXACTEMENT APPROPRIEE]

D. Clerc Jan. 1967 25 p refs Transl. into ENGLISH from Rech. Aerospatiale (Chatillon-sous-Bagneux), No. 111, 1966 p 41–52
(RAE-LIB-TRANS-1213) CFSTI: HC $3.00/MF $0.65

When the two near-frequency modes are found in the course of a resonance test in which the excitation force distribution is not exactly correct, it is impossible to obtain pure modes that rigorously satisfy the phase criterion, and it is therefore very difficult to separate these modes and determine their true natural frequencies. However, it seems possible to overcome this difficulty by introducing corrections determined by calculation. A method is presented which enables more accurate results to be determined theoretically, if some conventional assumptions are made and provided that the experiments include additional measurements of the velocity components of the response in quadrature with the excitation. (These components would be zero if the excitation were correct.) Author

N67-27793 Royal Aircraft Establishment, Farnborough (England).
THE STRENGTH OF BONDED SINGLE LAP METAL JOINTS SUBJECTED TO FATIGUE LOADING AT ROOM TEMPERATURE AND AT 100°C [FESTIGKEITSVERHALTEN VON UEBERLAPPTEN METALLKLEBUNGEN UNTER SCHWINGEN DER BEANSPRUCHUNG BEI RAUMTEMPERATUR UND BEI + 100°C]
W. Althof Dec. 1966 49 p refs Transl. into ENGLISH from German
(RAE-LIB-TRANS-1207) CFSTI: HC $3.00/MF $0.65

Single lap joints of aluminum alloys and stainless steel bonded with an epoxy–phenol adhesive have been subjected to fatigue loading at +20°C and +100°C. The effect of the overlap length, and the metals used, on the fatigue strength has been investigated. Smith diagrams were plotted for bonds with different overlap lengths. Author

N67-27803 Rome Univ. (Italy). Aerospace Research Center.
CONTRIBUTION TO THE STUDY OF "PANEL FLUTTER" [CONTRIBUTO ALLO STUDIO DEL "PANEL FLUTTER"]
Paolo Santini and Renato Barboni Dec. 1966 30 p refs in ITALIAN; ENGLISH summary Sponsored in part by C.N.R. *Its* ATTI No. 14
CFSTI: HC $3.00/MF $0.65

The problem of panel flutter with general boundary conditions is considered. The determination of stability boundaries and critical frequencies for semiinfinite plate elastically restrained is performed at the different boundaries stiffnesses, both considering and neglecting the aerodynamic damping. Author (ESRO)

N67-27897# Atomic Energy of Canada, Ltd., Chalk River (Ontario). Nuclear Labs.
THE PROPAGATION OF CRACKS OF FINITE WIDTH
M. R. Piggott Jan. 1967 28 p refs
(AECL-2847) CFSTI: HC $3.00/MF $0.65

In most materials, and especially metals, plastic flow occurs at a stress well below the theoretical strength. Cracks in a stressed material can therefore always be expected to have a finite width. An attempt is made here to develop a theory for the propagation of such cracks in an ideal elastic-plastic material. The analysis indicates that cracks that are very much longer than the critical length can be stable, and that in all materials there is a stress below which cracks of any length can be present without the material failing. However, the observed relation between failure strength and crack length in metals can only be explained if it is assumed that the plastic work done when an infinitely thin crack is propagated is proportional to crack length and independent of applied stress. A criterion for brittleness is derived which accords well with the common observation that hard materials are usually brittle. Author

N67-27908# General Electric Co., San Jose, Calif. Atomic Power Equipment Dept.
LOW-CYCLE FATIGUE STRENGTH REDUCTION IN NOTCHED FLAT PLATES
E. Krempl Jan. 1967 32 p refs
(Contract AT(04-3)-189)
(GEAP-5410) CFSTI: HC $3.00/MF $0.65

After a brief review of the design procedure in high-cycle fatigue an approach is outlined for the low-cycle fatigue region. A differentiation between a stress and a strain approach seems to be mandatory in evaluating the influence of stress raisers on low-cycle fatigue life. Good correlation was found when analytical elasto-plastic strain values were compared with strain gage measurements in the root of the notch of flat-plate specimens under monotonic loading. Low-cycle fatigue tests on edge-notched flat-plate specimens of three standard piping materials at room temperature under pulsating tension loading were analyzed under special consideration of crack initiation and crack propagation. Fatigue–strength–reduction factors were derived and compared with the proposed approach. Author (NSA)

N67-27933# National Lucht-en Ruimtevaartlaboratorium, Amsterdam (Netherlands).
BUCKLING OF RECTANGULAR SANDWICH PLATES UNDER BIAXIAL COMPRESSION
J. B. De Jonghe and F. J. Plantema Oct. 1966 38 p refs Submitted for publication
(NLR-TN-S-641) CFSTI: HC $3.00/MF $0.65

Buckling loads and interaction curves are derived for plates having all four edges clamped, or two opposite edges clamped and the other two simply supported. The analysis is based on Bijlaard's method of split rigidities in combination with the energy method. A comparison is made with results derived elsewhere without the use of Bijlaard's method. A simple procedure for computing additional results without the use of the computer programme is given in the appendix. Author (ESRO)

N67-27949# Springfield Armory, Mass.
DYNAMIC LOADING RESEARCH FOR TRANSIENT LOAD APPLICATIONS
Hubert H. Cadle *In* Army Dept. Proc. of the 1966 Army Sci. Conf., Vol. I 26 Aug. 1966 p 119–133 ref (See N67-27941 15-34)
(AD-634666)

A materials testing facility has been established for determining mechanical properties related to a specific transient load application. A strain gauge is used on the inside surface of the test specimen to detect the first yielding due to internal pressure, without introducing outside surface yield reading errors. The experimental correlation between inside and outside surface strains can be determined, and good pressure simulation has been achieved for particular transient load requirements. A specific application and the required testing procedures are described, along with testing machine development and data acquisition techniques. M.W.R.

N67-27969# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
MATERIALS FOR USE IN MITIGATING BLAST LOADS ON DEEPLY BURIED PROTECTIVE STRUCTURES
George C. Hoff *In* Army Dept. Proc. of the 1966 Army Sci. Conf., Vol. I 26 Aug. 1966 p 485–499 refs (See N67-27941 15-34)
(AD-634691)

A technique for controlling the magnitude of the force on buried protective structures makes use of backpacking for shock isolation. Such material placed around the structure dissipates a portion of the shock energy in the free field and thereby reduces the magnitude of the forces reaching the structure. Since the response of the backpacking and that of the structure are completely

interdependent, designs for both must be considered at the same time. A naturally occurring friable aggregate, a foamed plastic, and an insulating are under investigation for their shock-dissipating and stress-transfer characteristics. Theoretical discussions are concerned with pressure–volume, stress–strain relations; energy absorption, stress transfer, and thickness determinations. Plastic–elastic granular and foamed material are discussed; as are plastic foams, honeycombs, and other elastoplastic materials. M.W.R.

N67-27976# Army Materials Research Agency, Watertown, Mass.
LARGE DEFELECTIONS OF THIN SHELLS OF REVOLUTION
John F. Mescall *In* Army Dept. Proc. of the 1966 Army Sci. Conf., Vol. II 26 Aug. 1966 p 99–111 refs (See N67-27971 15-34)
(AD-634624)

Several solutions for the large deflection behavior of thin shells of revolution are presented. Numerical solutions for equations governing the large axisymmetric deflections of the geometric variables are found by a Gaussian elimination scheme and Newtonian iterative procedures. Complete global solutions to axisymmetric equations for spherical shells under concentrated loads, under uniform pressure, and under distributed loads show that they are sometimes adequate for stability prediction, depending on loading and/or boundary conditions. G.G.

N67-27980# Picatinny Arsenal, Dover, N. J. Feltman Research Labs.
HYDRODYNAMIC ELASTIC PLASTIC THEORY AND PLANE SHOCK WAVES IN METALS
James C. Pearson *In* Army Dept. Proc. of the 1966 Army Sci. Conf., Vol. II 26 Aug. 1966 p 183–197 refs (See N67-27971 15-34)
(AD-634630)

Effects of shock wave propagation and decay on the strength of solids were examined through the magnitude of their rarefaction waves. A model for the strength of a metal which has been shocked was developed by determining the pressure and the deviatoric stress behind the shock front. An attempt was made to predict work hardening produced by a plane shock wave and the following plane rarefaction wave. Also considered were shock waves in powders and heterogeneous materials. G.G.

N67-27984# Army Materials Research Agency, Watertown, Mass.
ASYMPTOTIC ANALYSIS OF THE AXISYMMETRIC VIBRATIONS OF SHELLS
Edward W. Ross, Jr. *In* Army Dept. Proc. of the 1966 Army Sci. Conf., Vol. II 26 Aug. 1966 p 259–273 refs (See N67-27971 15-34)
(AD-634635)

The present paper describes an attempt to apply asymptotic theory to a class of problems in shell dynamics, namely, finding the solutions for elastic, axisymmetric shells executing simple-harmonic axially symmetric vibrations. The purpose of the investigation is to obtain approximations to the general solutions of the governing system of equations and to find out what we can about the general properties of these solutions. Although we expect that the results will be helpful in calculating natural frequencies and mode shapes, consideration of such problems will be deferred to other occasions. Thus, we shall ignore the question of boundary conditions here and focus all our attention on the differential equation system. Author

N67-27992# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
THE ELASTIC RESPONSE OF BURIED CYLINDERS IN SAND
R. E. Walker, G. E. Albritton, and T. E. Kennedy *In* Army Dept. Proc. of the 1966 Army Sci. Conf., Vol. II 26 Aug. 1966 p 433–447 refs (See N67-27971 15-34)
(AD-634648)

The elastic response of a stiff steel cylinder, buried in dry sand, to dynamic loads from explosion charges was evaluated for burial depths of at least one diameter and a cylinder stiffness of 164. Results showed that moment and thrust plots as functions of overpressure did not determine alone the pressure distribution around the cylinder; the measured maximum experimental strain was higher than theoretically predicted values. It was concluded that the use of elastic theory to predict maximum thrust is not applicable if the stress location is a function of burial depth in a nonlinear medium. G.G.

N67-27996# Watervliet Arsenal, N. Y.
MINIMUM WEIGHT FOR COMPOSITE TUBES
John E. Zweig and Michael J. Pascual *In* Army Dept. Proc. of the 1966 Army Sci. Conf., Vol. II 26 Aug. 1966 p 557–567 refs (See N67-27971 15-34)
(AD-634656)

A thick-walled cylindrical tube consisting of a liner or inner cylinder and a jacket or outer cylinder of dissimilar meterials is investigated. The objective is to determine minimum tube weight for entirely elastic response to any required maximum internal working pressure. This is accomplished by optimizing liner and jacket dimensions and the residual stresses resulting from the fabrication process. The results are intended to provide a preliminary guide for the design of tubes using a metallic liner and a composite jacket which may be a fiberglass or similar wrapped filament structure in a suitable matrix. Author

N67-28093# State Univ. of New York at Buffalo. Div. of Interdisciplinary Studies and Research.
FORCED MOTION OF CIRCULAR PLATES
Herbert Reismann and James E. Greene Mar. 1967 108 p refs
(Grant AF-AFOSR-988-66)
(AFOSR-67-0565; AD-649383) CFSTI: HC $3.00/MF $0.65

A formal solution is obtained for the dynamic response of a circular or ring-shaped plate under arbitrarily distributed, time-dependent transverse loads and a set of very general stationary or time-dependent boundary conditions. The solution is obtained for an improved plate theory which includes the effects of transverse shear deformation and rotatory inertia. A normal mode technique is used wherein the dynamic solution is represented as an eigenfunction expansion about the static solution. Detailed and specific solutions are then presented for two axisymmetric problems: (a) the response of a solid, clamped plate to a suddenly applied transverse load, uniformly distributed over a circular area, and (b) the response of a ring plate, clamped at the outer boundary and subjected to a suddenly applied transverse shear at the inner boundary, which is restrained from rotating. Results of the improved theory for these two cases are compared with the predictions of the classical Poisson - Kirchhoff plate theory for various plate thickness ratios and loading parameters. Significant differences in the predictions of the two theories are found. Author (TAB)

N67-28252# California Inst. of Tech., Pasadena. Div. of Engineering and Applied Science.
ON THE STRESS ANALYSIS OF OVERLAPPING BONDED ELASTIC SHEETS
Rokuro Muki and Eli Sternberg Feb. 1967 38 p refs
(Contract Nonr-220(58))
(TR-10; AD-649275) CFSTI: HC $3.00/MF $0.65

The investigation deals with the load-transfer between two overlapping, continuously bonded, elastic sheets of different thickness and distinct material properties, under a given in-plane loading. It is shown first that the foregoing stress-analysis problem is--within the theory of generalized plane stress--reducible to an

elastic-inclusion problem. This general reduction scheme is subsequently applied to the specific problem concerning the transfer of loading between two overlapping semi-infinite sheets, attached to each other along a common strip adjacent to their edges, if one of the sheets is subjected to an internal concentrated force at right angles to its boundary. The solution obtained for this problem is studied in detail with particular attention to the quantitative appraisal of the bond forces acting throughout the interior of the region of adhesion and those communicated by the edges of the two sheets under consideration. Author (TAB)

N67-28278 Wisconsin Univ., Madison. Mathematics Research Center.

ON THE ELASTIC BUCKLING AND BENDING OF SANDWICH PLATES

Shun Cheng and N. Al-Rubayi Nov. 1966 43 p refs
(Contract DA-31-124-ARO(D)-462)
(MRC-TSR-70; AD-649086) CFSTI: HC $3.00/MF $0.65

A governing differential equation for the buckling and bending of sandwich plates with orthotropic cores is derived from a system of differential equations which is developed by means of a variational theorem. Solution of this resultant equation may be readily obtained through the use of the techniques that have been applied in the classical theory of plates. An example in which three boundary conditions at each edge of the plate are satisfied is presented for illustrative purposes. Curves of buckling coefficients are shown in figures. Author (TAB)

N67-28299*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

UNIAXIAL AND BIAXIAL FRACTURE TOUGHNESS OF EXTRA-LOW INTERSTITIAL 5Al-2.5Sn TITANIUM ALLOY SHEET AT 20°K

Timothy L. Sullivan Washington, NASA, Jun. 1967 22 p refs
(NASA-TN-D-4016) CFSTI: HC $3.00/MF $0.65 CSCL 20K

An experimental investigation was conducted to determine the effect of sheet width and notch length on the calculated fracture toughness values of 0.020-inch-thick (0.051 cm) extra-low-interstitial (ELI) grade of the titanium alloy Ti-5Al-2.5Sn at 20°K. Through-the-thickness center notches ranging in length from 1/8 inch (0.32 cm) to one-third of the specimen width were placed in specimens 3, 6, and 12 inches (7.6, 15.2, and 30.5 cm) wide. Sharp notches were obtained by electrical discharge machining and low-stress fatiguing to the desired length. Critical crack length was measured with the continuity gage. The Griffith–Irwin theory was used to calculate the fracture toughness values. Tests of specimens with notches 1 inch (2.5 cm) long or longer in all three sheet widths produced nearly constant values of fracture toughness. Tests of specimens with shorter notch lengths produced higher fracture toughness values, the use of which could result in unconservative designs. By neglecting the Irwin plastic zone correction term, nearly constant nominal fracture toughness values were obtained from specimens with notches as small as 1/4 inch (0.64 cm). A correlation between flat sheet and through-cracked cylindrical pressure vessels is included which shows good agreement with experimental data. Author

N67-28332# Stanford Univ., Calif. Dept. of Aeronautics and Astronautics.

ON A PERTURBATION PROBLEM IN STRUCTURAL DYNAMICS

Clive L. Dym and Maurice L. Rasmussen Dec. 1966 36 p refs
(Contract AF 49(638)-1276)
(SUDAAR-281; AFOSR-66-1667; AD-649002) CFSTI: HC $3.00/MF $0.65

Perturbation solutions for the differential equation governing dynamic buckling of an elastic column are discussed. A region of validity is suggested for a solution of Hoffs, and an alternate solution which complements the original solution is presented. Results of both cases are compared with results of numerical integration of the full equation. Author (TAB)

N67-28371*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

LOW CYCLE FATIGUE OF NOTCHED SPECIMENS BY CONSIDERATION OF CRACK INITIATION AND PROPAGATION

S. S. Manson and M. H. Hirschberg Washington, NASA, Jun. 1967 29 p refs
(NASA-TN-D-3146) CFSTI: HC $3.00/MF $0.65 CSCL 20K

An approximate analysis has been developed whereby the number of cycles required to start an engineering-size crack and the number of cycles required to propagate this crack to failure could be estimated for a notched specimen from a knowledge of the fatigue behavior of unnotched specimens. Cracks are assumed to occur at the root of a notch in a number of cycles which depend only on the localized surface strain. Propagation of the crack, once initiated, is assumed to proceed in a manner similar to that in an unnotched specimen. Reasonably good predictions of crack initiation, propagation, and total life were obtained for annealed 4340 steel and 7075 T6 aluminum notched specimens with elastic stress concentration factors of 2 and 3. Author

N67-28383# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

PRODUCTION OF HONEYCOMB CONSTRUCTIONS [PROIZVODSTVO SOTOVYKH KONSTRUKTSIY]

V. Ye. Bersudskiy, V. N. Krysin, and S. I. Lesnykh 13 Jan. 1967 241 p refs Transl. into ENGLISH of the book "Mashinostr.", Kiev, Izdatel., 1966 p 1–282
(FTD-MT-66-105; TT-67-61395; AD-649422) CFSTI: HC $3.00/MF $0.65

The book considers questions concerning the designing and production of glued and soldered constructions having a honeycomb or cellular filler, used widely in aviation, automotive, ship-building industry and in construction. Information is given about the design and strength of articles with a honeycomb filler made of nonmetallic materials such as aluminum and titanium alloys, and also of stainless steel. Manufacturing technology of honeycomb fillers is given as well as designs on their basis; material and equipment are described for the mechanization and automation of production and control of honeycomb fillers as well as articles with these fillers. Author (TAB)

N67-28387# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

BOUNDARY EQUILIBRIUM OF CYLINDRICAL REINFORCED SHELLS WITH THIN SHEATH

Ke-tse Huang 5 Dec. 1966 31 p refs Transl. into ENGLISH from Li Hsueh Hsueh Pao (Peking), v. 7, no. 2, 1964 p 91–108
(FTD-HT-66-407; TT-67-61336; AD-649037) CFSTI: HC $3.00/MF $0.65

A calculation model is discussed in which the thin sheath of a cylindrical reinforced shell is under the action of the stress of a thin membrane and the stress variation with the height of reinforcement is considered. Boundary conditions are found for a cylindrical shell under symmetrical deformation. The application of the boundary conditions obtained on maximum load is explained in a computation example of a singly supported cylindrical shell under the condition of uniformly distributed lateral and peripheral stress. TAB

N67-28412# Bettis Atomic Power Lab., Pittsburgh, Pa.

CALCULATION OF STRESSES IN PRESSURIZED CYLINDERS WITH EXTERNAL FILLETS USING THE DUZ-1 PHILCO-2000 COMPUTER PROGRAM

D. S. Griffin and A. L. Thurman Jan. 1967 19 p refs
(Contract AT(11-1)-GEN-14)
(WAPD-TM-654) CFSTI: HC $3.00/MF $0.65

Stress distributions in pressurized cylinders with external fillets were calculated using the DUZ-1 computer program. Although the range of r/t and T/t ratios investigated was limited, the results demonstrate the applicability of DUZ-1 to such problems, even for very small fillet radii (r = 0.0625 in.). Pipe and fillet dimensions were chosen to coincide with those being investigated experimentally by the Pressure Vessel Research Committee so as to provide ultimate verification of the numerical method. Author (NSA)

N67-28443# Southwest Research Inst., San Antonio, Tex.
STUDIES OF THE FATIGUE STRENGTH OF PRESSURE VESSELS. PART II: PREDICTION OF THE LOW CYCLE FATIGUE LIFE AND TERMINAL FAILURE BEHAVIOR OF PRESSURE VESSELS Technical Summary Report
A. G. Pickett and S. C. Grigory Feb. 1967 71 p refs
(Contract AT(11-1)-1228)
(SWRI-1228-1-36, Pt. 2) CFSTI: HC $3.00/MF $0.65

Work on cyclic pressure tests of full-size pressure vessels has been summarized and presented. Discussions and results of investigations of crack initiation and propagation and terminal failure of the vessels are presented. Author (NSA)

N67-28515# North American Aviation, Inc., Los Angeles, Calif.
MODELING TECHNIQUES FOR SONIC FATIGUE PREDICTION Final Report, May 1964–Oct. 1965
Paul Wang Wright-Patterson AFB, Ohio, AF Flight Dyn. Lab., Jun. 1966 139 p refs
(Contract AF 33(615)-1743)
(NAA-TFD-64-490-13; AFFDL-TR-65-171; AD-648078) CFSTI: HC $3.00/MF $0.65

The principles of static and dynamic similitude were applied to typical complex structural components for the purpose of examining the application of modeling techniques to sonic fatigue predictions. Modeled specimens of curved panels, honeycomb sandwich flat panels, and honeycomb sandwich cantilever beams have been tested. The tests were conducted on full scale 5/8, and 3/8 size models. The tests and analyses demonstrated that scale reductions of linear panel dimensions, and other size factors necessary in the fabrication of models, may be separately considered in maintaining the established similitude relationships. Both random spectra and discrete frequency acoustic excitation are considered. Stress correlation is the critical parameter in modeling for acoustic fatigue. True models with exact geometric scaling in all elements are not necessary. Adequate modeling is obtained by maintaining the same aspect ratio and modes for the specimen and model. The frequency and stress then vary at predetermined magnitudes with a functional relationship to damping, amplitude, and cross-section (thickness) geometric parameters. Non-linear effects are dependent on excitation levels. In general, a prerequisite to sonic fatigue tests is a knowledge of the non-linearity induced by damping and amplitude for each specimen. The experimental data confirms the application of basic procedures formulated by Miles, Palmgren, and Miner which minimize the requirement for random excitation in the use of modeling. Author (TAB)

N67-28548# J. G. Engineering Research Associates, Baltimore, Md.
ELASTIC–PLASTIC RESPONSE OF STRUCTURES TO BLAST AND IMPULSE LOADS
Joshua E. Greenspon Mar. 1967 42 p refs
(Contract DA-18-001-AMC-1019(X))
(AB-7; Rept.-7; AD-651051) CFSTI: HC $3.00/MF $0.65

The report discusses the general types of failures of typical structures that are used in aircraft and missiles. The theories of elastic and plastic deformation of these structures are presented and comparison with experiments of simple structures is given. It is found that the side on impulse can be used together with rigid-plastic theory of buckled and collapsed cylinders to predict plastic deformation for a wide range of pulse durations. For beam type structures the impulse and rigid plastic approximations seem to only hold for pulses of very short duration. Author (TAB)

N67-28613# Army Materials Research Agency, Watertown, Mass.
TEMPERED MARTENSITE EMBRITTLEMENT AND FRACTURE TOUGHNESS IN 4340 STEEL
Eric B. Kula and Albert A. Anctil Jan. 1967 29 p refs
(AMRA-TR-67-03; AD-651066) CFSTI: HC $3.00/MF $0.65

Tempered martensite embrittlement (500 F embrittlement) was studied in 4340 steel by means of Charpy impact, tension, and fracture toughness tests carried out over a range of test temperatures. Embrittlement was shown in the impact tests by a minimum in room temperature impact properties for tempering temperatures ranging from 500 to 650 F, the same range for which the transition temperature is a maximum. No evidence of embrittlement was found in tension or room temperature fracture toughness tests. Embrittlement was noted, however, in fracture toughness tests carried out at -50 and -100 F, which indicates that low temperature testing will be necessary for proper materials evaluation. The plane strain fracture toughness (K sub Ic) of various heats of 4340 steel has been correlated with the weight percent sulfur and phosphorus in the steel. A mechanism for tempered martensite embrittlement is proposed. Certain impurity elements, such as phosphorus, which are more soluble in ferrite than in cementite, will segregate in the ferrite adjacent to the cementite shortly after the cementite precipitation. This transient enrichment of ferrite by impurity elements will be embrittling when the cementite is in a platelet or filmy form, and particularly so in the region of the prior austenite grain boundaries, where the impurity content may be higher than average. Author (TAB)

N67-28614# Polytechnic Inst. of Brooklyn, N. Y. Dept. of Aerospace Engineering and Applied Mechanics.
INVESTIGATION OF PLATES AND SHELLS UNDER EXTERNAL LOADING AND ELEVATED TEMPERATURES Final Report, 1966
Joseph Kempner Mar. 1967 18 p refs
(Contract AF 49(638)-1360)
(PIBAL-933; AFOSR-67-0931; AD-651204) CFSTI: HC $3.00/MF $0.65

The report describes investigations of plates and shells under external loading and elevated temperatures, and includes problems of special interest to designers of missiles and aircraft. Chapter 1 discusses the analysis of the postbuckling (large-deflection theory) of noncircular (oval) cylindrical shells under axial compression and related experimental investigations, the application of exact finite deformation theory of three-dimensional elasticity to the stability problem of thick-walled cylinders under combined lateral pressure and axial compression, and investigations of nonlinear membrane shell problems. Chapter 11 describes work on the analysis of the effects of concentrated loads applied to reinforcing frames of finite and infinitely long circular cylindrical shells. Chapter 111 presents the results of investigations of the effects of creep in structures, with particular emphasis on the effects of line loads, the bending of variable thickness circular plates, and stress concentrations due to circular holes in large plates under uniaxial or biaxial loads. Author (TAB)

N67-28619# New York Univ., N. Y. Dept. of Aeronautics and Astronautics.
AN EXTENSION OF THE KANTOROVICH METHOD
Arnold D. Kerr Aug. 1966 22 p refs
(Grant AF-AFOSR-178-66)
(NYU-AA-66-70; AFOSR-66-2794; AD-651206) CFSTI: HC $3.00/MF $0.65

An extension of the Kantorovich method is proposed. The suggested method is demonstrated on the torsion problem of a beam of rectangular cross section. It is found that even when the solution is restricted to a one term approximation, the method generates very good results also for stresses which are obtained as derivatives of the solution. It is also found that the convergence of the iterative process is very rapid. The obtained results indicate that the proposed method is a powerful tool to generate close approximate solutions thus eliminating an inherent shortcoming in the Ritz and Galerkin methods, namely the arbitrariness in the choice of an approximate solution. Author (TAB)

N67-28647*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SPACECRAFT STRUCTURES
In its Res. and Advanced Develop., Vol. II 31 Jan. 1967 p 137–159 refs (See N67-28641 15-34)

Beryllium and its alloys are being evaluated in terms of spacecraft applications. Planetary entry heat shields, spacecraft landing dynamics, potential aerothermoelastic problems on unmanned Mars entry vehicles, and spacecraft shell and planetary entry aeroshell structures are under consideration. M.W.R.

N67-28697# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
APPLICATION OF A CORRECTIVE-FUNCTION METHOD IN CALCULATIONS OF DEFORMATIONS OF CANTILEVER PLATES
V. M. Frolov 20 Feb. 1967 59 p refs Transl. into ENGLISH of the book "Primeneniye Metoda Korrektiruyushchey Funktsii v Raschetakh Deformatsiy Konsol'nykh Plastin" USSR: Oborongiz, 1957 p 1–35
(FTD-MT-64-365; TT-67-61674; AD-651084) CFSTI: HC $3.00/MF $0.65

A method of calculating bending deflections and stresses for rectangular and triangular cantilever plates is given. The calculations are conducted on the assumption that plate cross sections parallel to the root are distorted during loading. The calculation method makes it possible to obtain values of functions of bending deflections and functions of certain stress components more precisely than by calculation according to the beam theory. The results of calculations by the proposed method are compared with the results of calculations of other authors and with experiments. Author (TAB)

N67-28705# Reactor Centrum Nederland, Petten.
DIGITAL REACTIVITY MEASUREMENTS BY A ROD DRIVE METHOD
E. Tuerkcan Feb. 1967 19 p refs
(RCN-65) CFSTI: HC $3.00/MF $0.65

The purpose of the rod drive method is to find the worth of a control rod in a short time. The method has been in use at Petten R.C.N. for more than a year for obtaining reactor control rod calibration curves and water-height reactivity coefficients in the ARGONAUT type low flux reactor, in the KRITO (critical experiment for a ship propulsion reactor) and in the high flux reactor H.F.R. The value of the reactivity controlled by a control rod is deduced from an analysis of the digitally measured reactor response to a slow movement of the control rod. Reactivity is obtained as a function of time, which can be easily converted to rod position. By using an automatic switching amplifier very large reactivity worths (up to 5%Δk/k) were measured with an accuracy, in the limit of one energy group, space independent kinetic equations, of few dollar cents. The method has also been used for measuring water-height reactivity coefficients. The results are found to be in good agreement with those obtained with the positive period method. Author (ESRO)

N67-28731*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
STAIR PROGRAM
M. S. Katow *In its* Computer Programs for Antenna Feed System Design and Analysis, Vol. 1 15 Apr. 1967 p 73 ref (See N67-28721 15-07)

A brief summary is presented on the structural analysis interpretive routine (Stair) 7094 program which computes joint deflections and bar stresses of large three-dimensional structures, i.e., the advanced antenna system 210-ft reflector assembly, assuming frictionless pin joints and axially loaded bars. The program calculates gravity loads of the bars on the joints of the structure and will accept inputted joint loads such as panel weights, wind loading, etc. The program is in Fortran II. Author

N67-28789*# Astro Research Corp., Santa Barbara, Calif.
DESIGN CRITERIA FOR LIGHTLY LOADED INFLATED STRUCTURES IN A NEAR-PLANETARY ATMOSPHERE
Peter G. Niederer 16 Feb. 1967 69 p refs
(Contract NAS7-427)
(NASA-CR-84829; ARC-R-246) CSCL 20K

For inflating a lightly loaded membrane, the simplest solution is offered by carrying a pressurization medium directly within the structure. The difference of state of this medium between the packed condition at the launching site and the deployed condition in the operating environment is used to deploy the body and then to rigidize it. Two near-earth environments and one near Mars are chosen for closer investigation. An exact knowledge is required of the equilibrium temperature a body attains due to radiative sources in space. Temperature can be regulated by the appropriate choice of the solar absorptivity and emissivity of the body surface. Pressurization substances are examined and their abilities to develop a certain pressure by varying the quantity used to inflate a given volume are investigated. An analysis is made to minimize the weight of an inflated body for a given task. The theory is applied to the bracing system of an X-brace Stokes flow decelerator. Author

N67-28809 Lockheed Missiles and Space Co., Palo Alto, Calif.
EXPERIMENTAL DETERMINATION OF THE CRITICAL FORCES OF A GLASS–PLASTIC CYLINDRICAL SHELL
V. S. Gumeniuk, V. S. Kravchuk, and V. V. Lushchik [1967] 5 p refs Transl. into ENGLISH from Prikl. Mekh., Akad. Nauk Ukr. RSR (Kiev), v. 3, no. 3 1967 p 42–45

Results are presented of tests to determine the lower and upper critical forces of a glass–plastic cylindrical shell compressed along the axis. The loading was performed on a universal testing machine, and the "loading-approach of the endfaces" diagram was recorded. The shell endfaces were reinforced and freely supported on flat steel discs. A table of the upper and lower values of the critical forces and the "loading-approach of the endfaces" diagram are given. Author

N67-28814 Lockheed Missiles and Space Co., Palo Alto, Calif.
EXPERIMENTAL METHOD OF INVESTIGATING HIGH-SPEED COLLISIONS OF SOLID PARTICLES WITH OBSTACLES AT VARIOUS ANGLES
G. S. Pisarenko and G. V. Stepanov [1967] 6 p refs Transl. into ENGLISH from Prikl. Mekh., Akad. Nauk Ukr. RSR (Kiev), v. 3, no. 3, 1967 p 1–5

A method is proposed for the experimental investigation of the collision of particles weighing 0.1–0.5 g with obstacles at various angles. A broad range of variation of velocities is obtained by utilizing two apparatus: a powder gun (200–2500 m/sec) and a light-gas accelerator (2000–8000 m/sec). A common method of measuring the velocity permits obtaining comparable data in the whole range of collision velocities. By utilizing a pendulum with two degrees of freedom, components of the shock impulse in two mutually perpendicular directions are determined (for impact at an angle). Author

N67-28815 Lockheed Missiles and Space Co., Palo Alto, Calif.
ON TRANSVERSE IMPACT ON A FLEXIBLE MEMBRANE
U. Bektursunov [1967] 4 p refs Transl. into ENGLISH from Vestn. Mosk. Univ., Mat. I Mekhan. (Moscow), no. 6, 1966 p 104–107

The problem of transverse impact on a plate by a sphere moving at the constant velocity is considered, where the wave velocity of a strong discontinuity exceeds the speed of sound in the material, i.e., only meridian motion originates at first, and then radial motion. Author

N67-28816 Lockheed Missiles and Space Co., Palo Alto, Calif.
ON THE QUESTION OF THE FREE VIBRATIONS OF A VARIABLE-MASS BODY
Iv. S. Tikhomirov [1967] 5 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Mashinostro. (Moscow), no. 12, 1966 p 35–40

Free vibrations of a reduced model of aviation transport units representing a vibrational system with variable mass are considered. Expressions are obtained for the amplitudes of the natural frequency and the phase angle as a function of the time both with and without taking account of the drag forces. Author

N67-28817# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON THE ANALYSIS OF AN ANISOTROPIC INHOMOGENEOUS CYLINDER WHOSE ELASTIC MODULUS IS A PIECEWISE-SMOOTH FUNCTION OF THE RADIUS
M. M. Plotnikov [1967] 4 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Mashinostro. (Moscow), no. 12, 1966 p 32–35

Material on the stress fields in anisotropic inhomogeneous cylinders whose elastic modulus E_r was defined by continuous, or almost-everywhere continuous, functions of the radius is briefly discussed. The stress field in an anisotropic inhomogeneous cylinder whose elastic modulus E_r is defined by a piecewise-smooth function of the radius is considered. The obtained results are compared with the solutions from the previous works. Author

N67-28819 Lockheed Missiles and Space Co., Palo Alto, Calif.
ON THE NONLINEAR VIBRATIONS OF A ONE-DIMENSIONAL ELASTIC OBJECT
R. F. Il'in and S. V. Kagadii [1967] 3 p refs Transl. into ENGLISH from Prikl. Mekh., Akad. Nauk Ukr. RSR (Kiev), v. 3, no. 3, 1967 p 120–122

Consideration is given to the problem of how the motion equations of a one-dimensional elastic object change under free flight conditions. The mutual effects of longitudinal, torsional, and three-dimensional transverse vibrations are taken into account along with their effect on the object's stability in flight. The solution involves the use of nonlinear equations for small elastic deformations. R.N.A.

N67-28837*# Lockheed Missiles and Space Co., Huntsville, Ala. Research and Engineering Center.
DESIGN OPTIMIZATION OF SANDWICH NOSE FAIRINGS
1 Mar. 1965 22 p refs
(Contracts NAS8-11148; NAS8-15485)
(NASA-CR-84832; LMSC/HREC-A710778) CFSTI: HC $3.00/MF $0.65 CSCL 20K

Sandwich nose fairings are worthy of serious consideration on large vehicles. A large factor to be considered is the structural efficiency or weight of such fairings, as compared to that for fairings built using competing structural concepts. Such comparisons can be realistically made between optimally designed sandwich and optimally designed ring stiffened sheet fairings by utilizing an existing computer program suitably modified for sandwich optimization. A recent development by Almroth of Lockheed's Solid Mechanics Laboratory of a method of determining the influence of core finite shear stiffness on the stability of sandwich cylinders makes possible a much more realistic comparision than has been possible in the past. Author

N67-28884# Air Force Systems Command, Wright-Patterson AFB, Ohio. Flight Dynamics Lab.
THERMAL TESTING OF EXPANDABLE SOLAR COLLECTORS Final Report
Allan W. Gunderson Dec. 1966 27 p
(AFFDL-TR-66-132; AD-649246) CFSTI: HC $3.00/MF $0.65

The solar collector test program was initiated to determine the structural response of expandable and unfurlable solar collectors to a simulated space thermal environment. The heating of the collectors was by T-3 infrared heat lamps, and cooling was obtained by liquid nitrogen boil-off. The collector structures in both instances performed as expected and no unusual deflections were measured. Author (TAB)

N67-28926# Royal Aircraft Establishment, Farnborough (England).
ON THE SIGNIFICANCE OF THE SUPPORTS WHEN CALIBRATING STRAIN GAUGE INSTALLATIONS FOR MEASURING LOADS ON AIRCRAFT
D. A. Drane Sep. 1966 12 p refs
(RAE-TR-66293) CFSTI: HC $3.00/MF $0.65

When calibrating strain gauge installations for measuring flight loads in the way suggested by Skopinski and others, the strain distribution and hence the gauge responses resulting from the application of a load to part of the structure will be affected by the position of the supports on which the aircraft rests. It is, however, shown that if the aircraft is supported so that the reactions are statically determinate, the response of any strain gauge to a particular loading system is the integral of the products of the elemental loads imposed by that system and the gauge responses obtained from the ground test. In consequence, the theoretical linear combination of strain gauges which measures exactly the load sustained by the structure and which is based on data obtained from the ground test is invariant with changes in the positions of the supports and thus may be used to measure loads applied in flight or in any other condition. Author (ESRO)

33 THERMODYNAMICS AND COMBUSTION

Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

N67-27788# British Oxygen Co., Ltd., London (England). Research and Development Dept.
IGNITION IN HIGH PRESSURE OXYGEN
M. Guter Min. of Aviation, Feb. 1967 56 p refs Sponsored in part by Min. of Supply
(S&T-Memo-13/50) CFSTI: HC $3.00/MF $0.65

The ignition temperatures of certain materials in oxygen at pressures up to 250 atm. were determined and the influence thereon of gas flow rate, oxygen concentration, heating rate and physical state of material. The materials fell into five groups: Lubricants including thread sealing compounds; Natural and synthetic rubber hose materials; Polymers; Valve seat materials; Metals and alloys. Author (ESRO)

N67-27852 Joint Publications Research Service, Washington, D. C.
STEADY THERMAL STATE OF SEMICONDUCTOR THERMO-COOLING DEVICES
E. I. Yermolina and N. M. Tarnovskiy *In its* Izv. VUZov: Instr. Bldg., Vol. 9, no. 6 27 Mar. 1967 p 140–146 refs (See N67-27821 15-14)

Approximate expressions are derived for the relationships between the hot and cold junctions of heat removing radiators, and between the volume and housing cooling of thermocooling devices and the intensity of the current in the thermoelements. These relationships take into account the structural features of the devices, the physical properties of the materials, and the heat exchange between the housing, radiator, and the surrounding space. The calculated results are confirmed experimentally. Author

N67-27935# Aerodynamische Versuchsanstalt, Gottingen (West Germany). Abteilung Aerodynamik.
THE DETERMINATION OF THE THERMODYNAMIC STATE OF RELAXING HYPERSONIC GAS FLOWS BY ELECTRON BEAM TECHNIQUE [DIE BESTIMMUNG DES THERMODYNAMISCHEN ZUSTANDES RELAXIERENDER HYPERSONISCHER GASSTROEMUNGEN DURCH ELEKTRONENSTOSSANREGUNG]
K. Buetefisch Sep. 1966 40 p refs In GERMAN; ENGLISH summary Presented at the Ann. Joint Meeting DGRR/WGLR, Bad Godesberg, W. Germany, Oct. 1966
(DGRR/WGLR Paper-66-114; AVA-FB-6611) CFSTI: HC $3.00/MF $0.65

For determining the thermodynamic state of relaxing hypersonic gas flows besides the static temperature and density also the vibration temperature must be measured. After discussing several possible measurement procedures a method for registering the vibration temperature with the aid of the electron beam technique on spectroscopic way is described. The special arrangement of the equipment makes it possible to register continuously at the same time besides the local vibration temperature also the local density as function of position or for a given position as function of total pressure or stagnation temperature. Author (ESRO)

N67-28127 Joint Publications Research Service, Washington, D. C.
ARGON-ARC HEAT SOURCE FOR HIGH-TEMPERATURE STUDIES
R. A. Ispiryan, B. F. Yermakov, and N. A. Yaryshev *In its* Izv. VUZov: Instr. Bldg., Vol. 9, No. 2 23 Feb. 1967 p 133–135 refs (See N67-28101 15-14)

A small argon arc heat source for high temperature materials testing is described. The source has an output in excess of 20 kw at currents up to 300 A. Increased output is obtained by installing a second copper or graphite jet to which a positive potential is fed after igniting. With this addition, voltage on the argon column in the source increased from 20 to 70 V at a current of 250 A; output changes from 5 to 17.5 kw, while the emerging stream diameter increases from 6 to 10 mm. The relationship between the specific heat flow of the emerging stream and the electrical output of the source is depicted. M.G.J.

N67-28167 Joint Publications Research Service, Washington, D. C.
DETERMINATION OF SPECTRAL COEFFICIENT OF REFLECTION, EMITTANCE, AND TRUE TEMPERATURE OF OPAQUE SOLIDS AT HIGH TEMPERATURES IN REFLECTOR FURNACES
V. V. Yanulis and I. S. Mayauskas *In its* Heliotechnol., No. 5, 1966 4 Apr. 1967 p 26–30 refs (See N67-28161 15-03)

A special device for determining the spectral coefficient of reflection, emittance, and true temperature of refractory materials at high temperatures in reflector furnaces was developed; and a line diagram and description of the device are presented. Scanning prisms are a unique feature of the device. Specimens of oxide ceramics in coarse grained masses on a basis of zirconium dioxide of two structure and magnesium oxide were studied. Plotted data indicate that the spectral coefficient for a wavelength of 0.65 microns depends on temperature, and very little on specimen structure. Zirconium dioxide has a higher spectral coefficient of emittance than does magnesium oxide. L.S.

N67-28169 Joint Publications Research Service, Washington, D. C.
A FREON-EJECTOR SOLAR REFRIGERATOR
A. Kakabayev and A. Davletov *In its* Heliotechnol., No. 5, 1966 4 Apr. 1967 p 37–43 refs Presented at the All-Union Conf. on Use of Solar Energy, Ashkhabad, USSR, 29 Oct. 1966 (See N67-28161 15-03)

Temperature and vapor pressure measurements were made during the testing of an experimental freon-ejector solar refrigerator designed for cooling air in a room. Data presented include measurements of temperatures at the boiler inlet and outlet, the condenser outlet, the vapor, cooled room, and outside air; humidity measurements of the outside air, cooled room air, and adjacent room air; vapor pressure measurements before the nozzle, and pressure behind the ejector; and the quantity of radiation falling on a perpendicular surface. The data indicate that the solar cooler is suitable for air conditioning. Their chief advantage is simplicity of the system and the feasibility of using heat of low potential. L.S.

N67-28182# Stanford Research Inst., Menlo Park, Calif.
HEAT-RELEASE KINETICS OF AMMONIUM PERCHLORATE IN PRESENCE OF CATALYSTS AND FUEL
S. H. Inami, W. A. Rosser, Jr., and H. Wise 9 Mar. 1967 16 p refs
(Contract Nonr-3415(00))
(PU-3473; AD-649268) CFSTI: HC $3.00/MF $0.65

The rate of heat release of ammonium perchlorate-fuel or ammonium perchlorate-catalyst or both under adiabatic condition was studied as a function of temperature. In the presence of catalysts, the autocatalytic feature associated with nucleation of pure ammonium perchlorate disappears and the adiabatic reaction kinetics follows Arrhenius-type behavior. Studies made with ammonium perchlorate-fuel show that measurable heat release occurs at temperatures below the phase transition temperature of ammonium perchlorate and that the rate of heat generation per mass of material is greater than that of pure ammonium perchlorate. The rate of exothermic decomposition of pure ammonium perchlorate is unaffected by an increase in pressure. This observation suggests that the heat release is controlled by homogeneous or heterogeneous reactions in the condense phase. Author (TAB)

N67-28185# Illinois Univ., Urbana. Coordinated Science Lab.
KINETIC THEORY OF RADIOMETRIC PHOTOPHORESIS IN A KNUDSEN GAS
Yau Wu Mar. 1967 22 p refs
(Contracts DA-28-043-AMC-00073(E); N00014-66-00010-A01)
(R-343; AD-649292) CFSTI: HC $3.00/MF $0.65

The kinetic theory of a small particle with arbitrary temperature distribution on its surface suspended in a Knudsen gas enclosed by an unequally heated boundary was established according to the revised law of thermal transpiration developed recently by Wu. The external force acting on the particle is mainly due to the radiometric force caused by the incident and the reflecting molecules in the absence of thermal creep effect in this limiting regime. Several particle shapes were considered, such as a small disk, flat plate, sphere and cube presented in a cylinder with uniform temperature gradient in a thermal transpiration system. Author (TAB)

N67-28296*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
STEADY-STATE PERFORMANCE OF A SEVEN-TUBE NaK-COOLED POTASSIUM CONDENSER
David B. Fenn, Loren W. Acker, and Harold H. Coe Washington, NASA, Jun. 1967 39 p refs
(NASA-TN-D-4020) CFSTI: HC $3.00/MF $0.65 CSCL 20M

Potassium vapor was condensed inside the tubes of a horizontal, multitube heat exchanger. The tubes were cooled with the liquid metal sodium potassium (NaK) flowing in a countercurrent direction in the space surrounding the tubes. Steady-state data are presented to show the effects of NaK coolant inlet temperature and coolant flow rate on the condensing length, the coolant temperature profiles, and the overall pressure drop of the condenser over a range of potassium inlet temperatures from 1200° to 1500°F. A correlation of the overall pressure drop on the potassium side of the condenser was obtained by plotting the ratio of the measured overall pressure drop to the velocity head in the tube inlet as a function of the condensing-length-to-diameter ratio. Author

N67-28338# Cincinnati Univ., Ohio.
THERMAL CONDUCTIVITY OF ALUMINUM OXIDE Technical Report, Sep. 1, 1965–Aug. 31, 1966
M. Hoch and A. Silberstein Wright-Patterson AFB, Ohio, AF Mater. Lab., Nov. 1966 28 p refs
(Contract AF 33(615)-1759)
(AFML-TR-67-12; AD-649274) CFSTI: HC $3.00/MF $0.65

The method developed earlier in our laboratory to measure thermal conductivity of materials at elevated temperatures has been applied to aluminum oxide. Aluminum oxide discs, 1/4 to 3/4 inches in diameter and variable height and grain size, were enveloped along the cylindrical surface in thin (0.001 inches thick) platinum foils. The platinum foil was heated by induction to 1500-1800K and it, in turn, heated the aluminum disc through radiation. The temperature distribution along the flat surface of the sample could be divided into two parts: toward the center of the sample, only volume (lattice and radiation) conduction was present; at the edge of the sample, the temperature rose rapidly, indicating a finite absorption zone. In this zone, the absorption of the radiation from the platinum heater is not complete yet, and therefore, the temperature distribution and heat transmission in the sample is influenced by the properties of the platinum. Author (TAB)

N67-28339# Hughes Aircraft Co., El Segundo, Calif. Space Systems Div.
LOCAL RADIATION EQUILIBRIUM TEMPERATURES IN SEMIGRAY ENCLOSURES Aerospace Technology Research Report
R. P. Bobco, G. E. Allen, and P. W. Othmer Dec. 1966 15 p refs
(RR-17; SSD-60475R; AD-648011) CFSTI: HC $3.00/MF $0.65

A rigorous analytical formulation is derived for computing local radiation equilibrium temperatures in diffusely reflecting, semigray cavities. Radiosity integral equations for solar and thermal radiation are related through a heat balance to obtain a third integral equation for the temperature distribution in an enclosure. The temperature equation is solved, in principle, by postulating a resolvant in terms of Fredholms solution. The solution is reduced to an approximate formulation suitable for engineering applications by introducing a mean value for the integral and using Hottels script eff in place of the resolvant. The resulting solution shows that local temperature depends on the sum of local direct solar energy, weighted diffusely reflected solar energy from other cavity regions, and weighted temperature of other regions. The analysis is completed by presenting closed-form expressions suitable for hand computation of mean temperatures in a semigray enclosure of two surfaces: (1) A concave surface which sees itself (shape factor F11 not = 0) and (2) a plane surface (F22 = 0). Numerical results are given for an L-shape geometry and a shallow circular cavity to compare the solutions derived in the paper to those obtained by computer nodal analyses. Author (TAB)

N67-28418# Linde Div., Union Carbide Corp., Ind.
A THERMAL INSULATION STUDY Quarterly Progress Report, Oct.–Dec. 1966
W. D. DeWitt 10 Feb. 1967 56 p refs
(Contract AT(30-1)-3632)
(ALO-3632-11) CFSTI: HC $3.00/MF $0.65

Small-scale processing tests were conducted on copper flake opacified Refrasil quartz fiber paper and tantalum foil. Offgassing tests were conducted on all of the candidate insulation materials and the data are being reduced. Refrasil quartz fiber paper and copper flake opacified Refrasil quartz fiber paper exhibited higher offgassing rates than the other candidates, and experiments are under way to re-evaluate the processing techniques used. Thermal conductivity tests were completed for the nickel foil–Astroquartz cloth composite and the aluminum foil–glass fiber paper composite. Thermal conductivity data for the experiments were reduced, and an equation defining the temperature dependence of the thermal conductivity is presented. The first vacuum enclosure candidate test specimen, Inconel-600, developed leakage after 300 hours of testing. Metallurgical examination indicated that failure was due to oxidation penetration, accelerated by stress. The desirability of another Inconel-600 specimen test will be evaluated during the next quarter. Author (NSA)

N67-28432# General Electric Co., San Jose, Calif. Atomic Power Equipment Dept.
DESIGN BASIS FOR CRITICAL HEAT FLUX CONDITION IN BOILING WATER REACTORS
J. M. Healzer, J. E. Hench, E. Janssen, and S. Levy Sep. 1966 37 p refs
(APED-5286)

A new design basis for predicting the critical heat flux in boiling water reactors was developed. The design basis is formulated on extensive tests with multirod geometries which accurately duplicate the reactor fuel assembly flow conditions. The test results were employed to formulate limit lines which fall below the experimental data. An analytical model to predict local flow and steam quality in complex geometries was also developed. The model was applied to the reactor fuel assemblies and to the multi-rod test sections to show that the test sections satisfactorily mockup the in-reactor behavior. Author (NSA)

N67-28442# General Motors Corp., Santa Barbara, Calif. Defense Research Labs.
FEASIBILITY STUDY ON SMALL PARTICLE ABLATION USING A FREE-FLIGHT RANGE
Daniel J. Collins, David K. Sangster, and Walter K. Rogers Albuquerque, N. Mex., Sandia Corp., Nov. 1966 61 p refs Prepared for Sandia Corp.
(Contract AT(29-1)-789)
(SC-CR-66-2128)

The feasibility of using a free-flight range to investigate the reentry behavior of small spherical particles (400 to 700 microns diameter) was experimentally investigated. Using laser photography, information was obtained of shape changes of particles in flight. Under the conditions of the experiments, it is concluded that Al_2O_3 spheres fragment as a result of thermal stresses. Author (NSA)

N67-28571# Air Products and Chemicals, Inc., Allentown, Pa.
RESEARCH ON THE ENTHALPY OF NITROGEN–OXYGEN–ARGON MIXTURES Final Summary Report, Apr. 1964–Oct. 1966

R. G. Clark and A. Piacentini Wright-Patterson AFB, Ohio. AF Aero Propulsion Lab., Jan. 1967 708 p refs
(Contract AF 33(615)-1332)
(AFAPL-TR-66-138; AD-649552) CFSTI: HC $3.00/MF $0.65

The enthalpy of mixtures of nitrogen, oxygen, and argon was measured and correlated over a wide range of compositions, pressures and cryogenic temperatures. A flow-type calorimeter was used to measure the enthalpy of 41 N2-O2-Ar mixtures in the composition ranges of 0-100% nitrogen, 0-100% oxygen, 0-5.0% argon, and pure argon in the temperature range from 125R to 400R and from 0.1 atm. to 25 atm. Twenty-six hundred data points were taken with the flow calorimeter. A static calorimeter was employed for measurement of the solid, melting, and liquid properties from 100R to 125R for those mixtures which form a solid at 100R. These experimental data, coupled with literature information, provided the basis for an internally consistent enthalpy correlation for the forty one mixtures from 100R to 560R and from 0.1 to 25 atmospheres. The correlated properties are presented in extensive tables. Pressure-enthalpy diagrams are included for nitrogen, oxygen, argon, and air. A nomograph for converting from mole fraction to weight fraction for N2-O2-Ar mixtures is presented. Author (TAB)

N67-28599# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
PLUTONIUM RELEASE STUDIES. II: RELEASE FROM IGNITED, BULK METALLIC PIECES
J. Mishima 10 Nov. 1966 29 p refs
(Contract AT(45-1)-1830)
(BNWL-357) CFSTI: HC $3.00/MF $0.65

Metallic Pu pieces ranging in weight from 455.5 to 1770 grams were ignited and allowed to oxidize completely in air at a velocity of 525 cm/sec. Release rates of 0.032 to 0.0045 weight percent per hour were found for the bare metal. Covering the ignited metal during oxidation with magnesium oxide sand reduced the release to 2.9×10^{-4} weight percent per hour. The median mass diameter of the particles airborne during the release from the bare metal was found to be 4.2 microns. Author (NSA)

N67-28605# California Univ., Berkeley. Div. of Applied Mechanics.
A LINEAR THEORY OF STRAIGHT ELASTIC RODS
A. E. Green, N. Laws, and P. M. Naghdi Feb. 1967 31 p refs
(Contract Nonr-222(69))
(AM-67-1; AD-651184) CFSTI: HC $3.00/MF $0.65

The paper is based on the work of Green and Laws who have given a general thermodynamical theory of rods which is valid for any material. Here, starting with the general non-linear theory of elastic rods, we derive a linear theory allowing for thermal effects. The resulting free energy as a quadratic function of kinematic variables is restricted by certain symmetry conditions. The basic equations then separate into four groups, two for flexure, one for torsion and one for extension of the rod with temperature effects occurring only in the latter group. Wave propagation along an infinite rod is considered. There are two wave speeds for each type of flexure, two for torsion and three for isothermal extension and all wave speeds depend on the wave length. Author (TAB)

N67-28606# California Univ., Berkeley. Div. of Applied Mechanics.
A CLASS OF VISCOELASTIC-PLASTIC MEDIA
A. E. Green and P. M. Naghdi Mar. 1967 19 p refs
(Contract Nonr-222(69))
(AM-67-2; AD-651185) CFSTI: HC $3.00/MF $0.65

A class of nonlinear constitutive equations of rate-type are considered for viscoelastic-plastic continua and explicit restrictions are derived from thermodynamics. Some aspects of the associated linearized theory with isothermal deformations are also discussed. Author (TAB)

N67-28648*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SPACECRAFT AEROTHERMODYNAMICS
In its Res. and Advanced Develop., Vol. II 31 Jan. 1967 115-136 refs (See N67-28641 15-34)

Attention is given to the reduction of uncertainties in predicting heat transfer and aerodynamic behavior during planetary entry in order to (1) assess such uncertainties in convective heat transfer distributions about high drag bodies at angle of attack in carbon dioxide-nitrogen-argon gas mixtures, (2) study flow fields about high drag bodies, (3) assess effects of shock layer ablation-products interaction on heat transfer, and (4) study radiative equilibrium and nonequilibrium heating rate distributions about high drag bodies for various planetary gas mixtures. Activities of hypervelocity laboratory are noted, including operations and development, and gas radiation and gas dynamics flow studies. Techniques and limitations of acoustic noise spectrum shaping are reported, as are studies on a 20-in supersonic wind tunnel and a 21-in hypersonic wind tunnel. M.W.R.

N67-28665# Deutsche Forschungsanstalt fur Luft- und Raumfahrt, Brunswick (West Germany). Institut fuer Strahlantriebe.
GENERATION OF HIGH STAGNATION TEMPERATURES BY PRECOMBUSTION OF HYDROGEN [ERZEUGUNG HOHER GESAMTTEMPERATUREN DURCH WASSERSTOFFVERBRENNUNG]
W. Alvermann Jan. 1967 22 p refs In GERMAN; ENGLISH summary
(DLR-FB-67-05) CFSTI: HC $3.00/MF $0.65

For mixture of air and oxygen heated by precombustion of hydrogen and containing 21% oxygen by volume which can be used as a substitute for air in thermogasdynamic investigations with high Mach number, the temperature of the air before combustion, required for predetermined temperatures of the mixture, is calculated for several hydrogen contents. Furthermore the equilibrium compositions of the different air-oxygen-hydrogen systems are determined for various temperatures and pressures. Author

N67-28672# Technische Hochschule Munchen (West Germany). Institut fuer Stroemungsmechanik.
THE CALCULATION OF THERMODYNAMIC PROPERTIES OF HIGH-TEMPERATURE AIR IN EQUILIBRIUM AND IN THE EQUILIBRIUM REGIME BEHIND A SHOCK [DIE BERECHNUNG DER THERMODYNAMISCHEN EIGENSCHAFTEN VON HOCHERHITZTER LUFT IM GLEICHGEWICHTSZUSTAND SOWIE IM GLEICHGEWICHTSBEREICH HINTER EINEM VERDICHTUNGSSTOSS]
E. Igenbergs and L. Roemer Deut. Versuchsanstalt fur Luft- und Raumfahrt, Jan. 1967 129 p refs In GERMAN; ENGLISH summary Sponsored by Deut. Forschungsgemeinschaft
(DLR-FB-67-06; Rept.-66/17)

A calculation procedure is developed using the equilibrium constants and the fundamental conservation laws. It permits a calculation of the thermodynamic variables like pressure, density, temperature, and the concentrations of the air components. These are functions of the free flow Mach number and air condition in front of the shock. Then a computation procedure is outlined for the air in equilibrium when the temperature and the density are given. The results are compared with other publications. Author

N67-28683# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EXPERIMENTAL INVESTIGATION OF INFLUENCE OF TURBULENCE OF FLOW ON HEAT EXCHANGE DURING MOTION OF AIR IN PIPES
I. T. Shvets, Ye. P. Dyban, M. V. Stradomskiy, and E. Ya. Epik 17 Mar. 1967 23 p refs Transl. into ENGLISH from Teplo i Massoperenos. Pervoe Vsesoyuznoe Soveshch. (Minsk), v. 3, 1963 p 370-381
(FTD-MT-65-367; AD-651087) CFSTI: HC $3.00/MF $0.65

Experiments were conducted on study of heat exchange during motion of air in relatively short pipes in range of Reynolds numbers 1,000 to 50,000 with consideration of initial turbulence of flow. Experimental material was a segment of EYaIT steel seamless pipe with internal diameter 51mm, wall thickness 1.5mm, and 4,000mm length. Conditions for experiment are described in detail. Results of experiments were processed to obtain dependence of average and local Nusselt number on Reynolds number at different sections of pipe for different magnitudes of Karman number. TAB

N67-28737*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
APPROXIMATION FOR RADIANT ENERGY TRANSPORT IN NONGRAY, NONSCATTERING GASES
R. W. Patch Washington, NASA, Jun. 1967 36 p refs
(NASA-TN-D-4001) CFSTI: HC $3.00/MF $0.65 CSCL 20M

An approximation for integrated intensity in nongray, nonscattering gases is presented that uses a new mean absorption coefficient in the gray-gas transport equation. This absorption coefficient is called an effective absorption coefficient. The approximation was tested by calculating the integrated intensities by exact and by approximate methods for 39 cases. The integrated intensities calculated by the effective absorption coefficient approximation had errors of only −25 to +28 percent, which demonstrated the superiority of this approximation over a similar approximation using the Planck mean absorption coefficient. Despite certain restrictions on the form of the spectral absorption coefficient, the effective absorption coefficient approximation is expected to be useful for most problems of nonscattering plasmas in local thermodynamic equilibrium even where large temperature and pressure differences and inhomogeneities are present. Author

N67-28738*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EXPERIMENTAL AND ANALYTICAL STUDY OF THE TRANSIENT SOLIDIFICATION OF A WARM LIQUID FLOWING OVER A CHILLED FLAT PLATE
Joseph M. Savino and Robert Siegel Washington, NASA, Jun. 1967 37 p refs
(NASA-TN-D-4015) CFSTI: HC $3.00/MF $0.65 CSCL 20M

Analytical predictions and experimental data are provided for the transient growth of a frozen layer that forms when a warm liquid flows over one side of a chilled flat plate. The plate is cooled to a temperature below the freezing point of the liquid by a coolant flowing along the other side of the plate. This could be encountered, for example, in a heat exchanger where water is being cooled by a cryogenic fluid. Three analytical procedures are employed and compared for accuracy and convenience in application. One is an iterative technique that yielded three closed-form solutions, each successive solution being a more accurate higher order approximation. Numerical results from the third approximation are presented graphically in sufficient detail so that rapid estimates of frozen layer growth can be made. In the experiment, water flowed over one side of a thin Inconel plate while the other side of the plate was cooled by flowing chilled alcohol. Transient ice growth was initiated by a sudden increase of the alcohol flow. The ice thickness and the plate surface temperatures were measured throughout the transient growth period and compared favorably with theoretically predicted values. Author

N67-28739*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PHOTOGRAPHIC STUDY OF CONDENSING MERCURY FLOW IN 0-G and 1-G ENVIRONMENTS
David Namkoong, Henry B. Block, Robert P. Macosko, and Clifford C. Crabs Washington, NASA, Jun. 1967 17 p refs Film Supplement C-251 and Lewis Motion Picture C-221 to this report are Available on Loan from Lewis Res. Center, Cleveland, Ohio
(NASA-TN-D-4023) CFSTI: HC $3.00/MF $0.65 CSCL 20M

High-speed motion pictures were taken of mercury vapor condensing in glass tubes in a ground facility and in a zero gravity facility. A range of mercury flow rates from 0.03 to 0.05 pound per second was investigated in constant diameter tubes ranging from 0.27 to 0.49 inch. The condensing lengths were fixed at 60 and 68 inches. Moving drops on the wall accounted for one-half or more of the liquid flow rate at any one station investigated along the condenser. The ratio of the observed average velocity of the drops in the vapor stream to the local vapor velocity varied from 0.3 at the inlet to 1.0 at approximately three-fourths of the condensing length from the inlet. In the aircraft zero gravity facility, the 1- and 0-g conditions had little effect on the liquid flow distribution in the 0.27-inch diameter tube. In the 0.40- and 0.49-inch diameter tubes, however, gravity made a substantial difference. In a 1-g environment, there was a concentration of drops on the tube bottom and a shallow sloping interface; in a 1-g environment there was a uniform distribution of drops and a vertically standing interface. Vapor pockets within the liquid leg formed and collapsed within a time interval of approximately 0.04 second. Author

N67-28778*# General Electric Co., Schenectady, N. Y.
RESEARCH AND DEVELOPMENT CENTER. AN ANALYSIS OF THERMALLY INDUCED FLOW OSCILLATIONS IN THE NEAR-CRITICAL AND SUPER-CRITICAL THERMODYNAMIC REGION
Novak Zuber Huntsville, Ala., Marshall Space Flight Center, NASA, 25 May 1966 178 p refs
(Contract NAS8-11422)
(NASA-CR-84801) CSCL 20K

A quantitative formulation and analysis are concerned with predicting the onset of low frequency flow oscillations as a function of fluid properties, system geometry, and operating conditions. The problem is analyzed by perturbing the inlet flow, linearizing the set of governing equations, and integrating them along the heated duct to obtain the characteristic equation, which is given by a third order exponential polynomial with two time delays. Conditions leading to aperiodic and periodic flow phenomena, pertaining to flow excursion and to the onset of flow oscillation, are investigated. Stability maps and stability criteria are presented which can be used to determine the region of stable and unstable operation and also the effects which various parameters have on promoting or preventing the appearance of flow oscillations. The effects of parameters are analyzed and improvements are suggested for eliminating the onset of flow oscillation. The similarity between chugging combustion instabilities and thermally induced flow oscillations at near and super-critical pressures is pointed out. Author

N67-28808# Royal Aircraft Establishment, Farnborough (England).
THE DETERMINATION OF THERMAL CONDUCTIVITY BY MEANS OF MELTING PHENOMENA
P. H. H. Bishop and K. F. Rogers Oct. 1966 23 p refs
(RAE-TR-66328) CFSTI: HC $3.00/MF $0.65

The property of melting is used to provide a cheap, quick, and reasonably accurate determination of thermal conductivity, needing very little preparation or apparatus. The thermal conductivity of calibrated Durestos and silica specimens have been measured using methods based on melting wax; values correct to within 3% for Durestos and 12% for silica were obtained. The method is free from the need for constant ambient conditions, and can accommodate specimens of moderate flatness and any reasonable size and shape. Author (ESRO)

N67-28821*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HEAT TRANSFER TO LIQUID-METAL FLOW IN A ROUND TUBE OR FLAT DUCT WITH HEAT SOURCES IN THE FLUID STREAM
Robert M. Inman Washington, D. C., Jun. 1966 33 p refs
(NASA-TN-D-3473) CFSTI: HC $3.00/MF $0.65 CSCL 20M

An analysis was carried out to determine the forced-convection heat-transfer characteristics for flow of a liquid metal in a flow passage with heat sources in the fluid stream. Two geometries commonly encountered in practice were selected for analysis: the circular tube and the parallel-plate channel, or flat duct. The study was based on the assumptions of (1) a fully developed velocity profile that is uniform over the passage cross section (slug flow), (2) molecular conductivity being appreciably larger than eddy conductivity, and (3) spatially uniform internal heat generation. The model is a fairly accurate representation for the turbulent flow of liquid metals for Péclet numbers less than 100. The results obtained apply along the entire length of the particular conduit, that is, in the thermal entrance region as well as in the region where the temperature profiles are fully developed. The eigenvalues and constants required for calculating temperature distributions and heat-transfer characteristics are determined analytically. The effects of the ratios that determine the relative role of internal heat generation to that of wall heat transfer or temperature driving force on the heat-transfer characteristics are investigated. Numerical results for wall temperatures, wall heat fluxes, and Nusselt numbers are presented graphically for a number of thermal boundary conditions that are of practical engineering interest. Author

N67-28861# Shell Research, Ltd., Chester (England). Thornton Research Centre.
TWO-STAGE COMBUSTION OF EXPLOSIVE MIXTURES. III: KINETIC ZONES OF SPONTANEOUS IGNITION OF ISO-OCTANE IN MIXTURES WITH AIR AT HIGH PRESSURES
S. A. Yantovskii [1966] 11 p refs Transl. into ENGLISH from Kinetika i Kataliz (USSR), v. 7, no. 1, Jan.–Feb. 1966 p 21–26
(TIL/OT-8331; TRANS-1124) CFSTI: HC $3.00/MF $0.65

Data are presented on the macrokinetic parameters of the two-stage spontaneous ignition of iso-octane in mixtures with air, $\alpha = 0.8$. It is shown that in the low temperature region two temperature zones are observed, from the minimum temperature up to 320° and from 320° to 450° with different kinetic parameters of spontaneous ignition. In the first temperature zone $E_{eff}^{CF} = 27.1$ kcal/mole, and in the second $E_{eff}^{CF} = 12.2$ kcal/mole. In the first zone E_{eff}^{CF} has a positive value, but in the second has a negative value. On comparison of the kinetic parameters of spontaneous ignition of iso-octane with heptane at high pressures, there is observed for iso-octane a slower rate of pre-flame oxidation in the first and in the second stages of spontaneous ignition in both kinetic zones. Author

N67-28883# Aerospace Research Labs., Wright-Patterson AFB, Ohio. Thermo-Mechanics Research Lab.
LAMINAR PARALLEL PLATE FLOW WITH ARBITRARY THERMAL CONDITIONS Final Report
Kenneth R. Cramer Jan. 1967 20 p refs
(ARL-67-0003; AD-649596) CFSTI: HC $3.00/MF $0.65

Laminar flow in flat plate heat exchangers may be subjected to asymmetric, nonuniform thermal conditions due to different environments in adjacent passages. The existing heat transfer solutions and methods are summarized and a general method is proposed for determining the temperature distribution in the flow between parallel plates with an arbitrary initial condition, arbitrary heat flux distribution along one plate and an arbitrary temperature distribution along the other plate. The method is applied for a parabolic velocity profile and the results are presented in terms of convolution integrals which require the Laplace inversion of functions determined from the specific boundary conditions selected by the user. Author (TAB)

N67-28955# Naval Research Lab., Washington, D. C.
PREDICTION OF ABSOLUTE ENTROPIES FROM GAS CHROMATOGRAPHIC RETENTION DATA
Frederick W. Williams and Homer W. Carhart 22 Mar. 1967 18 p refs
(NRL-6529; AD-651036) CFSTI: HC $3.00/MF $0.65

Absolute entropies of compounds in homologous series of hydrocarbons, ketones, and alcohols were found to be directly related to the logarithm of the retention volumes obtained from gas-liquid chromatographic measurements. Different liquid substrates and column temperatures have been employed in the collection of retention data. The retention volume method can be employed as a fast and relatively inexpensive way of predicting absolute entropies of organic compounds. Author (TAB)

34 GENERAL

Includes reports of a broad nature related to industrial applications and technology, and to basic research; defense aspects; law and related legal matters; and legislative hearings and documents.

N67-27923# Industrieanlagen-Betriebsgesellschaft m.b.H., Ottobrunn (West Germany). Operations Research Gruppe.
EVALUATION OF MILITARY AIR TRANSPORT SYSTEMS [BEWERTUNG VON MILITAERISCHEN LUFTTRANSPORT-SYSTEMEN]
D. Fischer 19 Aug. 1966 37 p refs In GERMAN; ENGLISH summary Presented at the Ann. Joint Meeting DGRR/WGLR, Bad Godesberg, W. Germany, Oct. 1966
(ORG/MS-7) CFSTI: HC $3.00/MF $0.65

The desirable size and composition of a military air transport fleet is a function of the expected wartime air transport requirements. From a large variety of air transport fleet mixes, which might feasibly fulfill the transportation requirements, those mixes can be assumed to be the most preferred that result in the least peacetime personnel and budget expenditures. This paper discusses an approach employed for the analysis of the wartime air transport requirements of the Bundeswehr and the determination of desirable fleet mixes from a number of transport aircraft types under consideration. The discussion of methodology is illustrated by some typical unclassified results. Author (ESRO)

N67-27941# Army Dept., Washington, D. C. Office, Chief of Research and Development.
PROCEEDINGS OF THE 1966 ARMY SCIENCE CONFERENCE, VOLUME I
26 Aug. 1966 560 p refs Conf. held at West Point, N. Y., 14–17 Jun. 1966
(AD-634615) CFSTI: HC $3.00/MF $0.65

Conference papers on Army in-house research and development efforts are presented. For individual titles see N67-27942–N67-27970.

N67-27943# Army Natick Labs., Mass.
APPLICATION OF QUANTIFIED TERRAIN DATA TO VEHICLE DESIGN CRITERIA
Robert L. Anstey *In* Army Dept. Proc. of the 1966 Army Sci. Conf., Vol. I 26 Aug. 1966 p 23–36 refs (See N67-27941 15-34)
(AD-634659)

Quantitative investigations are required of the microgeometry of the world's landforms to develop terrain design criteria for increasing off-road capability for moving supplies. These data must be reduced and presented in useable forms to permit comparative

analysis with critical vehicle performance characteristics, and a cooperative effort among many government agencies is recommended. A method that uses the alluvial fan as the focal point is presented for the development of quantitative terrain data with wide application to the many landform types over the world. Parameters of the problem are noted, microgeometric aspects of the problem are discussed, and vehicle characteristics are considered. Alluvial fan obstacle slope frequency distribution is tabulated. Close agreement is noted between alluvial fan characteristics in Southwestern United States and in West Pakistan, and other similar climates over the world have analagous slopes and profiles. M.W.R.

N67-27971# Army Dept., Washington, D. C. Office, Chief of Research and Development.
PROCEEDINGS OF THE 1966 ARMY SCIENCE CONFERENCE, VOLUME II
26 Aug. 1966 585 p refs Conf. held at West Point, N. Y., 14–17 Jun. 1966
(AD-634616) CFSTI: HC $3.00/MF $0.65

Conference papers on Army in-house research and development efforts are presented. For individual titles see N67-27972–N67-27996.

N67-27972# Army Tank-Automotive Center, Warren, Mich.
WALKING MACHINE STUDIES
Ronald A. Liston *In* Army Dept. Proc. of the 1966 Army Sci. Conf., Vol. II 26 Aug. 1966 p 17–31 refs (See N67-27971 15-34)
(AD-634618)

The state-of-the-art in walking machine design with servocontrol provisions for the human operator is reviewed for possible application in jungle warfare. Based on the results, a biped and a quadruped vehicle form evolved as most feasible both from mechanical design and human factors viewpoints. The quadruped selected will be able to operate at a speed of about 5 mph and will carry a payload of 500 pounds; its front legs will be controlled by the operator's arm and the rear legs by his legs. G.G.

N67-27989# Army Combat Developments Command Artillery Agency, Fort Sill, Okla.
A MODEL FOR DETERMINING TARGET LOCATION ACCURACY REQUIREMENTS
Otis S. Spears *In* Army Dept. Proc. of the 1966 Army Sci. Conf., Vol. II 26 Aug. 1966 p 355–367 refs (See N67-27971 15-34)
(AD-634642)

This study encompasses a method of determining target accuracy requirements when other components of the weapon system are specified. Damage potential is related to target location errors for single-volley coverage of the target; measured results on multiple volley coverage and effectiveness showed that changes in single-volley coverage of a target by a weapon effects pattern can be used as basis for determining critical reductions in effectiveness of multi-volley cannon fire. G.G.

N67-27997# Army Dept., Washington, D. C. Office, Chief of Research and Development.
PROCEEDINGS OF THE 1966 ARMY SCIENCE CONFERENCE, SUPPLEMENT
31 Mar. 1967 91 p Conf. held at West Point, N. Y., 14–17 Jun. 1966
(AD-647010) CFSTI: HC $3.00/MF $0.65

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N67-27998# Los Alamos Scientific Lab., N. Mex.
KEYNOTE ADDRESS
Harold M. Agnew *In* Army Dept. Proc. of the 1966 Army Sci. Conf., Suppl. 31 Mar. 1967 p 3–14 ref (See N67-27997 15-34)

In-house research and development of the US Armed Forces in the field of applied technology is outlined. The importance of further research in area-denial weapons, ambush detection, night vision, sea infiltration, detection of missile sites, infrared detectors, etc., is projected by the speaker. G.G.

N67-27999# Defense Dept., Washington, D. C.
BANQUET ADDRESS
John S. Foster, Jr. *In* Army Dept. Proc. of the 1966 Army Sci. Conf., Suppl. 31 Mar. 1967 p 17–23 ref (See N67-27997 15-34)

Practical problems and applications of research and development in the Armed Forces are discussed with emphasis on assured destruction programs. Land warfare and counter infiltration situations demand better sensors and detectors to minimize the number of ground forces and to find guerillas, sites, and enemy aircraft flying overhead. G.G.

N67-28520# Congress. Senate. Committee on Aeronautical and Space Sciences.
AERONAUTICAL RESEARCH AND DEVELOPMENT POLICY
Washington, GPO, 1967 189 p refs Hearings before Comm. on Aeron. and Space Sci., 90th Congr., 1st Sess., 25–26 Jan., 27 Feb. 1967
GPO: $0.50

A review is presented of the adequacy of policy planning for aeronautical research and development and of what the Congress, the executive branch of the government, and private industry can do to insure that national aeronautical goals are met. Attention is focused on policy planning, with particular emphasis on the organization and mechanism in the Federal Government that provides for planning, programming, funding, and managing of aeronautical research and development. The review is in the form of the customary statements and testimony by committee members and witnesses. K.W.

N67-28542# Pennsylvania State Univ., University Park.
BIBLIOGRAPHY OF CLASSICAL AND CONTAGIOUS DISCRETE DISTRIBUTIONS
Ganapati P. Patil and Sharadchandra W. Joshi Wright-Patterson AFB, Ohio, ARL, Sep. 1966 278 p refs
(Contract AF 33(615)-2763)
(ARL-66-0185; AD-651113) CFSTI: HC $3.00/MF $0.65

The report provides a bibliography of classical and contagious discrete distributions which lists 2113 publications in statistics and probability discussing discrete distributions in general. Publications in other fields discussing applications of these distributions were also included. Textbooks as a class were excluded, but the more intimate ones were included. Technical reports and dissertations were treated as published papers. A systematic search was made for most of the entries published in English during the period ending 1964. Some of the later publications discovered and found relevant are also included. The original objective of achieving comprehensive coverage of non-English publications was partially abandoned due to lack of adequate resources. Author (TAB)

N67-28574# Congress. House. Committee on Science and Astronautics.
NASA AUTHORIZATION, 1968, PART 3, NO. 2

Washington, GPO, 1965 1202 p Hearings before Comm. on Sci. and Astron., 89th Congr., 1st Sess., 4–26 Mar. 1965
GPO: $3.50

Described are the 1966 NASA authorization hearings before the subcommittee on space science and applications of the Science and Astronautics Committee of the US House of Representatives. Areas covered are biotechnology and human research, manned space flight, geology and weather observations, physics and astronomy, and space medicine. G.G.

N67-28575# Congress. House. Committee on Science and Astronautics. Subcommittee on Advanced Research and Technology.
NASA AUTHORIZATION, 1966, PART 4, NO. 2
Washington, GPO, 1965 750 p Hearings Before Comm. on Sci. and Astron., 89th Congr., 1st Sess., 2–18 Mar. 1965
GPO: $2.25

The 1966 NASA authorization hearings before the subcommittee on advanced research and development of the Science and Astronautics Committee of the U.S. Congress are presented. Budgetary statements cover data acquisition and tracking facilities and operations, nuclear propulsion and space power systems, biotechnology and human research, technology utilization, electronics and control, and chemical propulsion. G.G.

N67-28576# Congress. House. Committee on Science and Astronautics.
SCIENCE, TECHNOLOGY, AND PUBLIC POLICY DURING THE EIGHTY-NINTH CONGRESS, JANUARY 1965 THROUGH DECEMBER 1966
Washington, GPO, 1967 202 p refs Hearings before Comm. on Sci. and Astron., 90th Congr., 1st Sess.

This report of the subcommittee on science, research, and development for the US House of Representatives Committee on science and astronautics describes the major Government-science relationships and activities during the 89th Congress. Graphically demonstrated is the impact of science and technology on modern society, and the difficulties and dangers which technological applied science may incorporate are revealed. The report is intended as legislative history and does not analyze the authorizations and appropriations behind it. G.G.

N67-28577# Congress. Senate. Committee on Aeronautical and Space Sciences.
NASA AUTHORIZATION FOR FISCAL YEAR 1968, PART 2
Washington, GPO, 1967 1031 p Hearings before Comm. on Aeron. and Space Sci., 90th Congr., 1st Sess., 21–27 Apr. 1967
GPO: $1.50

Comprehensive prepared statements concerning advanced space propulsion systems, materials, electronic circuitry, vehicle structures, space suits, power systems, equipment, and other advanced space technology matters presented in hearings before the Committee on Aeronautical and Space Sciences of the United States Senate are recorded. Tables, photographs, diagrams, and charts, in support of the discussions are included. L.S.

N67-28578# Congress. Senate. Committee on Aeronautical and Space Sciences.
NASA AUTHORIZATION FOR FISCAL YEAR 1968 PART 1
Washington, GPO, 1967 568 p refs Hearings before Comm. on Aeron. and Space Sci., 90th Congr., 1st Sess., 18–20 Apr. 1967
GPO: $2.00

Budgetary hearings before the Committee on Aeronautical and Space Sciences of the United States Senate cover NASA appropriations for the fiscal year 1968; considered are research and development, construction of facilities, administrative operations, and other expenses. G.G.

N67-28579# Congress. House. Committee on Appropriations.
INDEPENDENT OFFICES AND DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT APPROPRIATIONS FOR 1968, PART 3
Washington, GPO, 1967 1266 p Hearings before Comm. on Appropriations, 90th Congr., 1st Sess.

Budgetary hearings before a subcommittee on appropriations for the House of Representatives are presented that pertain to the Department of Housing and Urban Development and the National Aeronautics and Space Administration. Covered are various budgetary questions in establishment and operation of the new Department of Housing, as well as current and projected expenditures for the NASA. G.G.

N67-28580# Congress. House. Committee on Science and Astronautics.
NASA AUTHORIZATION, 1968, PART 1, NO. 2
Washington, GPO, 1967 702 p Hearings before Comm. on Sci. and Astron., 90th Congr., 1st Sess., 28 Feb.–8 Mar. 1967
GPO: $2.25

The text of the congressional hearings for the NASA budget authorizations is presented. Details of the various appropriations are discussed, and include such areas as research and development, construction of facilities, and administrative operations. C.T.C.

N67-28641*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
RESEARCH AND ADVANCED DEVELOPMENT. VOLUME II: SUPPORTING RESEARCH AND TECHNOLOGY FOR THE OFFICE OF ADVANCED RESEARCH AND TECHNOLOGY, NATIONAL AERONAUTICS AND SPACE ADMINISTRATION Semiannual Review, 1 Jul.–31 Dec. 1966
31 Jan. 1967 542 p *refs*
(Contract NAS7-100)
(NASA-CR-84793; JPL-TM-33-322, Vol. II) CFSTI: HC $3.00/MF $0.65

Articles on space power and electric propulsion systems, space vehicle systems, electronics systems, chemical propulsion, chemical rocket experimental engineering, and research programs are presented. For individual titles see N67-28642–N67-28683.

N67-28710# Royal Aircraft Establishment, Farnborough (England).
DETERMINATION OF THE OPERATING QUALITIES OF AUTOMOBILE TYRES BY THE MODELLING METHOD [OPREDELENIE EKSPLUATATSIONNYKH KACHESTV AVTOMOBIL'NYKH SHIN METODOM MODELIROVANIYA]
S. M. Tsukerberg and R. K. Gordon Nov. 1966 14 p refs Transl. into ENGLISH from Avtomob. Prom. (Moscow), no. 11, 1965 p 28–31
(RAE-LIB-TRANS-1198) CFSTI: HC $3.00/MF $0.65

A modeling procedure for the design of tires is described. From the differential equation for the equilibrium of a tire, three relevant nondimensional groups are deduced. In a series of tests with models and full-scale tires certain parameters such as fiber diameter, tire pressure, stress in the fiber, and cord angle are made identical. Author

N67-28758*# Washington Univ., St. Louis, Mo. Dept. of Economics.
METHODS OF GOVERNMENT ASSISTANCE TO RESEARCH AND DEVELOPMENT
Murray L. Weidenbaum Jun. 1967 21 p refs *Its* Working Paper 6705
(Grant NsG-342)
(NASA-CR-84820) CFSTI: HC $3.00/MF $0.65 CSCL 05C

It has been proposed that plans for attaining rapid expansion of economic growth should emphasize speeding up technical change and innovation. This paper deals with one possibility for accelerating

such applications of science and technology: governmental encouragement of the private performance of research and development (R&D). An examination of such efforts in the more rapidly developing nations reveals that a wide variety of mechanisms exists through which governmental authorities can encourage private R&D undertakings. This study both indicates the major categories of such public aid and also presents some of the limitations to their effectiveness. Author

N67-28770*# Washington Univ., St. Louis, Mo. Dept. of Economics.

STRATEGIES FOR DIVERSIFICATION OF DEFENSE/SPACE COMPANIES

Murray L. Weidenbaum Jun. 1967 40 p refs *Its* Working Paper 6704

(Grant NsG-342)

(NASA-CR-84805) CFSTI: HC $3.00/MF $0.65 CSCL 05A

Specific guidelines are developed for defense/space companies desiring to utilize their specialized capabilities in other markets. The positive approach presented consists of a blend of the lessons from past defense/space marketing and diversification experiences and the concepts and methodology of modern business planning. Five areas of potential market diversification are examined: surface transportation, hydrography or water systems, communication systems, atmospheric research and control, and area development. An enumeration is made of the specific factors to be analyzed in selecting one or more of these fields for defense/space industry diversification. Author

N67-28780*# California Univ., Berkeley. Space Sciences Lab.

THE BASIS OF SCIENTIFIC CHOICE OR ON CRITERIA FOR PUBLIC SUPPORT OF SCIENCE AND TECHNOLOGY

D. J. Montgomery Mar. 1967 46 p refs *Its* Internal Working Paper 48

(Grant NsG-243)

(NASA-CR-84798) CSCL 05A

A scheme for rational allocation of public resources for the support of science and technology is proposed. It aims to supplement and rationalize the body of technical information on which decisions are in part based. The scheme goes out from the explicit recognition that any governmental activity is undertaken for its contribution to a multiplicity of common goals. It then requires any proposed activity to be evaluated with respect to the potential contribution to each of the common goals. The guiding principle in setting up the evaluation procedures is to seek commensurable alternatives between which choices are to be made. The results of the evaluation process are submitted to the government officials who are responsible for decision, as an input that they are to take into account in arriving at the allocation of government resources. The scheme can be generalized to aid in establishing priorities among programs within specific scientific-technological missions as well as to aid in allocating government resources among broad national goals. Author

N67-28792*# National Aeronautics and Space Administration, Washington, D. C.

GOALS FOR URBAN AMERICA

James E. Webb 23 May 1967 14 p Presented at the Conf. on Urban Govt. in the Decade Ahead: The Technol. Revolution in Management, Philadelphia

Available from the Scientific and Technical Information Division CSCL 05D

The use of modern science and technology to obtain an overview of many urban problems is proposed in an address by James E. Webb, NASA Administrator. It is pointed out that the power to predict enables man to decide better between alternatives. The impact of space exploration on society by making data available to scientists for enhanced comprehension and prediction is stressed. The requisite innovative management connected with the development and use of large computers and similators in scientific research is also mentioned. N.E.N.

N67-28818# Bureau of Mines, Pittsburgh, Pa.

NEW GAP-SENSITIVITY METHODS FOR EXPLOSIVES

R. L. Grant, N. E. Hanna, and R. W. Van Dolah Washington, D. C. May 1967 22 p refs

(BM-RI-6947) CFSTI: HC $3.00/MF $0.65

Two new gap-sensitivity methods were developed for explosives, and especially permissible explosives, to overcome certain disadvantages of the present routine half-cartridge method. The revised methods are based on the statistical up-and-down method and give more useful measurements of the 50-percent gap values than the nonstatistical routine method. The new methods use full cartridges and incorporate certain physical improvements such as the use of cardboard tubes for containing the explosives and coal dust gaps to simulate actual mining conditions. A total of 60 samples of permissible explosives were evaluated simultaneously with the 2 improved methods and with the half-cartridge method. Author

N67-28901# RAND Corp., Santa Monica Calif.

BIBLIOGRAPHY ON AUTOMATION AND TECHNOLOGICAL CHANGE AND STUDIES OF THE FUTURE

Annette Harrison Mar. 1967 28 p refs

(P-3365-2; AD-650074) CFSTI: HC $3.00/MF $0.65

This Paper comprises a list of works collected for two ongoing RAND projects: Automation and Technological Change, and a related informal study of future national and international problems. This list is by no means exhaustive; it consists solely of materials assembled to date by project members. New entries, which have been added since the last updating of this Paper in October 1966, are indicated by asterisks. Author (TAB)

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—NATIONAL AERONAUTICS AND SPACE ACT OF 1958

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